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Electrical World

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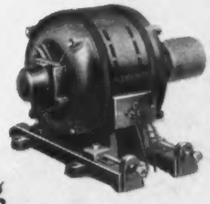
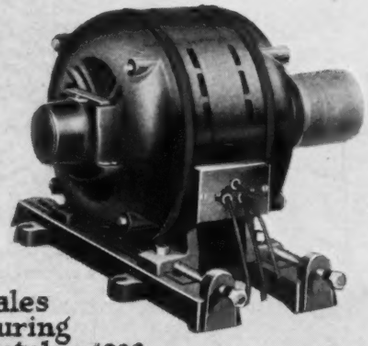
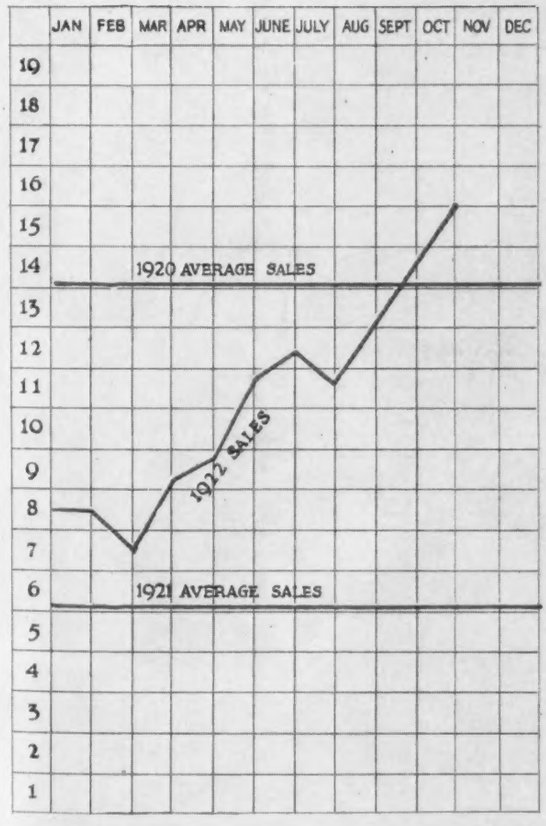


Sales During October 1921

Comparison of sales in October 1921 and 1922 is represented by the two Howell Red Band Motors.



Sales During October 1922



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Volume 80 — New York, Saturday, November 25, 1922 — *Number* 22

Distribution—Who Will Cheapen It?

CLOSE to 80 per cent of all the books and pamphlets written on business subjects in the last three years, it is said, have dealt with the problem of distribution. At every industrial convention the need for better distribution comes up for discussion. We hear it constantly the topic of conversation.

There can be no doubt as to what all this talk means. It means that public opinion is becoming steadily more attentive, more definite and more determined on the subject. And, in the end, public opinion compels and controls in these United States.

THE man on the street is no expert on economic problems. He does not know what is wrong with the business organism. But it so happens that it affects him in a very personal and a persistent way.

He buys a certain electric labor-saving appliance for his home for, say, $125 and finds out by chance that the cost of manufacturing that device was but $50. The retailer assures him that he is not profiteering, but agrees that the price is too high. The jobber admits that the price is too high, but tells him that he has taken virtually no profit at all. The householder can make no head or tail of it, but only knows that somewhere between the factory and his back door $75 has been spent on a commodity that cost just $50 to produce.

This example is but typical of a thousand others like it, and all the explaining in the world cannot make this sort of thing seem right in the minds of the buying public. Apparently nobody is taking too much in profit, but the money is being spent just the same. Therefore the public demands with growing insistence some new sort of a "set-up" in the system of distribution that will not cost so much to get the goods to the consumer. It puts it up to management to find the way.

MEN who have thought deep into this situation agree that this high cost of distribution in all industries is not caused by profiteering. Dealers today want 50 or 60 per cent where a few years ago 25 per cent was ample, but it is because of the excessive cost of doing business that these larger margins are exacted. Then, again, too many styles and varieties are made in too many duplicating factories in too small volume. Too many like lines are stocked and shipped out on too many small orders. And it costs too much compared with what it would cost for mass production and mass distribution. Prices are high, it seems, because manufacturers', wholesalers' and retailers' expenses are so high.

But the public demands relief. Will electrical men and other industries, we wonder, find ways to cut down their costs by co-operation among themselves or will they wait until Congress is driven by public clamor to tackle the whole job with many perhaps ill-considered laws?

Paul Martyn Lincoln

A pioneer in electrical generation and transmission who is the new director of the School of Electrical Engineering at Cornell University.

BOTH Cornell University and Paul M. Lincoln are to be congratulated on the appointment of the latter to be director of the School of Electrical Engineering at Ithaca, N. Y. Since the death of Alexander Gray, Cornell has been seeking a director who incorporated the qualities found in Mr. Lincoln. The appointment now made will be greeted with satisfaction by the profession as showing breadth of view on the part of those responsible for the choice. He is an engineer with an international reputation, and his accomplishments have a historical background in his intimate knowledge of the developments in his profession. Through his personal contributions to the profession in the design and operation of electrical equipment and through his extensive acquaintanceship, writings and affiliations with engineering organizations he has had a marked influence on the activities of the electrical industry. His training, judgment, standing and administrative ability augur a future for electrical engineering at Cornell that will add to the prestige of the past.

Born in Norwood, Mich., Jan. 1, 1870, Mr. Lincoln was educated in the public schools and at Ohio State University, where he received the degree of E.E. in 1892. After a brief term with the Short Electric Company in Cleveland, he became connected with the Westinghouse Electric & Manufacturing Company and interested himself in the pioneer problems connected with the alternating-current system. In 1895 he joined the Niagara Falls Power Company to supervise the electrical installation of that company, and here he gained worldwide fame through his invention of the Lincoln synchronizer. For this achievement he received a bronze medal at the Buffalo exposition in 1901 and the John Scott medal of the Franklin Institute in 1902.

Mr. Lincoln returned to the Westinghouse company in 1902 and was occupied with power department developments and allied commercial problems until 1919, when he resigned to take up consulting work and active participation in the development of the Lincoln Electric Company. He has been connected with many societies, being a fellow and past-president of the A. I. E. E. and a member of A. S. M. E., S. P. E. E., Franklin Institute, American Electrochemical Society and other organizations. He is affiliated with several social clubs and has served as a director of the engineering department of the University of Pittsburgh.

Still a young man, Mr. Lincoln has the talent and experience to contribute largely to the upbuilding of American engineering education.

Editorial Comment

Electrical World, November 25, 1922

Volume 80 Number 22

In Defense of the Water-Power Law

WHATEVER shortcoming there may be in the water-power law, two things about it are certain —it is workable and just, and it commands the support of bankers, engineers, conservationists and the electrical industry. The law was a long time in preparation, and it has been a cause of congratulation that so wise and broad a measure was finally enacted. Apparently, however, the public did not fully appreciate the fact that by the passage of the law the government had adopted a policy of fifty-year leases, for the act was hardly in effect when along came Henry Ford with his Muscle Shoals offer, demanding a hundred-year lease. That his efforts have thus far been unsuccessful is significant, but still more significant is the fact that the water-power law had few to do it reverence even in Congress; for the main arguments against the Ford offer were not predicated on its contravention of the legislation so hardly won, but on things foreign to it.

Fortunately the danger of this attitude has been recognized, and a group of public-spirited citizens and statesmen interested in water power and conservation has been marshaled to defend the law against insidious attacks. Development can be and is being made under the act as it now stands—the records of the Federal Power Commission show that—and not until development comes to a standstill because of the law should any modifications be permitted. Deplorable as it is, the tendency of the day is to regard all law lightly. None the less, government cannot break faith with those who have accepted fifty-year leases, and it is well that men of standing outside of Congress have drawn attention to this obligation.

Superpower in Russia Now Under Way

IN THIS country superpower brings to mind mammoth generating stations. In Russia the new Kashira station comes under this classification. The difference is one of degree, not of principle. We use a great deal of electrical power in a comparatively circumscribed district, while the Russians are really only getting to know electricity as an agent for light, heat and power.

One must at least commend the spirit and ambition of the soviet government with respect to its attitude and accomplishments in engineering. A really valuable power survey of Russia has been made by a competent group of Russian engineers under governmental auspices. This was followed up by the building of the Kashira station and transmission line—the first link in the contemplated chain.

These results were accomplished despite many handicaps. As pointed out by Dr. Steinmetz in his article in this issue, the chaotic industrial condition necessitated makeshifts in the construction of the station and line. The use of a wooden pipe line, of many types of line towers and insulators and of other improvised materials showed the ingenuity of the engineers. The information may be of value to other engineers who cannot obtain the materials for standard American construction when working in foreign countries.

Otherwise than in the display of initiative and ingenuity with respect to construction materials and methods, the new station embodies no radical departure from American standards. It seems to follow American ideas of layout to a very great extent. The engineering difficulties met by Russians in electrical power problems can best be solved by a study of American engineering methods and practice, because this country has similar dimensional conditions as regards territorial area and has passed through similar pioneer experiences with respect to low-load densities and transmission distances.

Accounting Classification Changed Once More

AS REPORTED elsewhere in this issue, the classification of accounts of electric light and power companies has been changed once more by agreement between the National Electric Light Association and the National Association of Railway and Utilities Commissioners. Similar changes were made for water and gas utilities. There will be some who will wonder why the 1920 classification adopted by the commissioners and later accepted by the N. E. L. A. had to be modified again. The answer is that while the 1920 classification was logical and entirely satisfactory to both commissioners and companies, the present change is made in the interest of uniformity and to reconcile certain elements brought into the situation by the Federal Power Commission's regulation.

While the commissioners and utility accountants were coming to an agreement the accounting authorities of the Federal Power Commission were, in accordance with the law, framing a classification for the use of federal licensees. The federal commission's staff were limited in their discretion by the terms of the act, which provided that fixed capital accounts were to be set up on the basis of the road and equipment accounts of the Interstate Commerce Commission for the use of steam roads as of 1914, and furthermore by Regulation 16 of the form of application for license, relating to depreciation.

The accounting committee of the commissioners' association could not accept accounts based on these modifications, and to that extent uniformity in regard to fixed capital accounts and so-called depreciation could not be accomplished. There will also be some further necessary variations from uniformity on account of special requirements of some state laws. Aside from these two matters, however, there was a great mass of accounting detail in which uniformity could and should be brought about, and to this end meetings of the power commission were held in September at which the Asso-

ciation of Railway and Utilities Commissioners, the National Electric Light Association and the Interstate Commerce Commission were all represented. As a result of these meetings certain modifications of the previous classification were agreed to. Aside from changes in handling depreciation, most of the modifications are principally changes in wording or minor changes of detail.

The classification of accounts now resulting from these modifications and adopted by the utility commissioners at their recent convention in Detroit is an adequate, logical and sound classification, and accounting officials of the National Electric Light Association hope and believe that it will remain the last word in electric light accounting procedure.

Coal Situation Still Menacing

WITH no desire to appear pessimistic or to cause undue alarm over the coal situation, we should be recreant to our duty if we did not advise public utilities and others to keep a careful watch on developments and take advantage of every opportunity to obtain and store coal. The outlook is far from reassuring. Indeed, the signs indicate a recurrence of the coal strike next spring, and at the present rate of production and shipment the shortage will be acute.

No matter what is done now, next year there will be no great surplus to draw on, and if a strike comes, the effect on all industry, unless the disturbance is of short duration, will be depressing. It will be a great service to the country if the fact-finding commission shall have made public by that time the vital facts bearing on the situation, but even the knowledge of such facts will be of little comfort when weighed against the one outstanding fact that coal will be hard to get. Therefore plans should be laid now for systematic storage of whatever surplus fuel is available.

Motor-Generator Must Look to Its Laurels in Mining Service

SIGNIFICANT improvements in the design of synchronous converters during the past decade have put this type of machinery upon a new plane of usefulness for general industrial service, according to J. L. McK. Yardley, who in this issue of the *Electrical World* skillfully sums up the importance of these advances in relation to mining applications and intimates that the time has come for the wider use of rotaries in this arduous field. The author points out that the high-reluctance commutating pole has increased by about 100 per cent the ability of the synchronous converter to operate without flashover under momentary overload conditions; that progress in the development of quick-action circuit breakers with inductance properly related thereto has literally "beaten the flashover to it" in choking back the rush of energy under short-circuit conditions and cutting off the rotary before harm can be done, and finally, that the automatic substation applied to mining service offers a further means of protection. It follows that the motor-generator must look to its laurels, since it suffers materially in efficiency comparisons with the synchronous converter and at substantially equal investment costs can be justified only on the ground of more reliable service.

Mr. Yardley has made out a very strong case for the rotary designed along these newer lines, and engineers will do well to obtain and make public available data upon performance in mining service as the use of such equipment grows. If operating gains of 3.5 to 9.5 per cent in energy consumption can be realized with little or no increase in investment and with virtually the same reliability of service, the motor-generator will find its popularity sharply restricted as time passes in mining activities.

However excellent a given machine, its ultimate value to the user depends in large measure upon its proper selection for the work in hand, to say nothing of adequate maintenance. Thorough engineering analyses of load conditions, feeder requirements and over-all costs should be made in applying either rotaries or motor-generators to particular mining installations. The problems of the mining load are well known today, but combinations of load conditions and geographical layouts deserve very careful study in selecting transforming equipment for this industry in particular cases. Mr. Yardley's article challenges electrical engineers on mining properties to undertake precisely these analytical comparisons when considering the applicability of synchronous converters. It is to be hoped that the results of such comparisons, and even more in the way of service records, will soon be forthcoming for the benefit of this important branch of electrical engineering.

Automatic Substation Applied to Alternating-Current Service for First Time

OPERATORS who have had experience with automatic substations for feeding direct-current circuits have in general expressed their belief that these stations improve service and have an economic advantage. This is because properly arranged automatic equipment goes through its cycle of operations in a small fraction of the time the human operator requires to clear his circuits, test them out, isolate such as may be in serious trouble and get the others back into service. The problem for the human operator is complicated still further if he must act under the direction of a dispatcher to protect the other parts of a large interconnected system. An automatic substation goes through the predetermined cycle of operations at such intervals as may have been found best, and at the end of the cycle the circuits in good condition are in service and those in serious trouble are locked out. The operation is measured in seconds rather than minutes, and there are no false moves and no excitement.

Just recently the Kansas City company applied the automatic substation to alternating-current service for the first time on a scale which aims to consider city territory as so many small towns or zones and to control each substation automatically. The description of its substation practice on another page of this issue reveals an almost complete replacement of the human operator by automatic apparatus. A drum controller handles the high-tension oil switches so that changes from one line to another can be made without interruption to service under normal conditions. Under abnormal conditions, with a transformer and its lines out of commission, the service lines are automatically switched to the spare bank and its lines. When the load on a station reaches a predetermined low limit, the unneeded transformers are automatically disconnected and their loads switched to the remaining transformers. These operations are handled through drum controllers by contact-making devices on the

switchboard that reflect the condition of each line and piece of apparatus and act independently of the relays called upon to interrupt circuits during abnormal conditions. This removes one source of possible trouble and permits complete separation of the control and relay circuits, and at the same time it keeps the control wiring largely in simple circuits.

In the Kansas City station particular attention has been paid to protection of adjoining circuits or apparatus from troubles occurring on any equipment in the substation. This has been done by arrangement of barriers and apparatus in such a way that the probable effects of even the most severe trouble cannot spread. The installation is an extremely interesting one, and its operating results point to the experience with automatic machinery that has been so often repeated—that when properly arranged the results obtained are superior to those from human labor because automatic equipment can be placed under absolute control and the human factor is eliminated.

The Discussion of the Cost of Merchandising—Where Will It Lead?

MORE men have thought and talked about the cost of merchandising electrical appliances in the last few weeks than ever before. This is well. John F. Gilchrist has shown that nine of the largest central-station companies have lost great sums of money on their retail selling and has given detailed figures on how much is lost on every washing machine sold by the Commonwealth Edison Company in Chicago. The American Washing Machine Manufacturers' Association has submitted figures on the cost of selling washers out of three other stores, claiming that the Gilchrist figures are excessively high. It is but accidental that the discussion has focused so closely on washing machines, and there seems to be no issue between Mr. Gilchrist and E. B. Seitz of the manufacturers. Both are arguing to the same point, which is that the central stations are not doing a good job of merchandising, because it is costing them too much to sell and they are losing money. They agree that there is urgent need for a thorough, fearless study of merchandising costs, that central stations may know what they are spending in appliance selling and what they must do to make this business profitable.

Mr. Gilchrist has recommended a general increase in prices to provide more profit for the central station. We have disagreed with this suggestion, in a former editorial, believing that a more efficient merchandising operation and an increased turnover will provide relief along more constructive lines and to the better interests of the central station, the independent dealer, the jobber, the manufacturer and the public. For neither Mr. Gilchrist's detailed costs on one appliance in one store nor his total figures on the total merchandising of nine large central stations nor the cost figures from the three stores cited by the washing machine association provide enough real data to give a true basis for analysis. There are three different ways to increase profits in retailing. You can improve the efficiency of the selling, increase the number of turnovers, or raise prices. But too little is known about the actual cost of merchandising electrical appliances today to make it sure just how much can be accomplished in any one of these directions toward reducing the losses of these nine large central stations.

What the industry needs is cost facts, developed by a study that embraces the entire country and all classes of electrical retailers. Perhaps smaller central stations are selling appliances more economically than large ones. Perhaps independent dealers are as a class making still larger profits. Who knows, today? But these facts must be found out before any central-station company can be certain that it is charging proper costs against its merchandising or doing its selling in the right way.

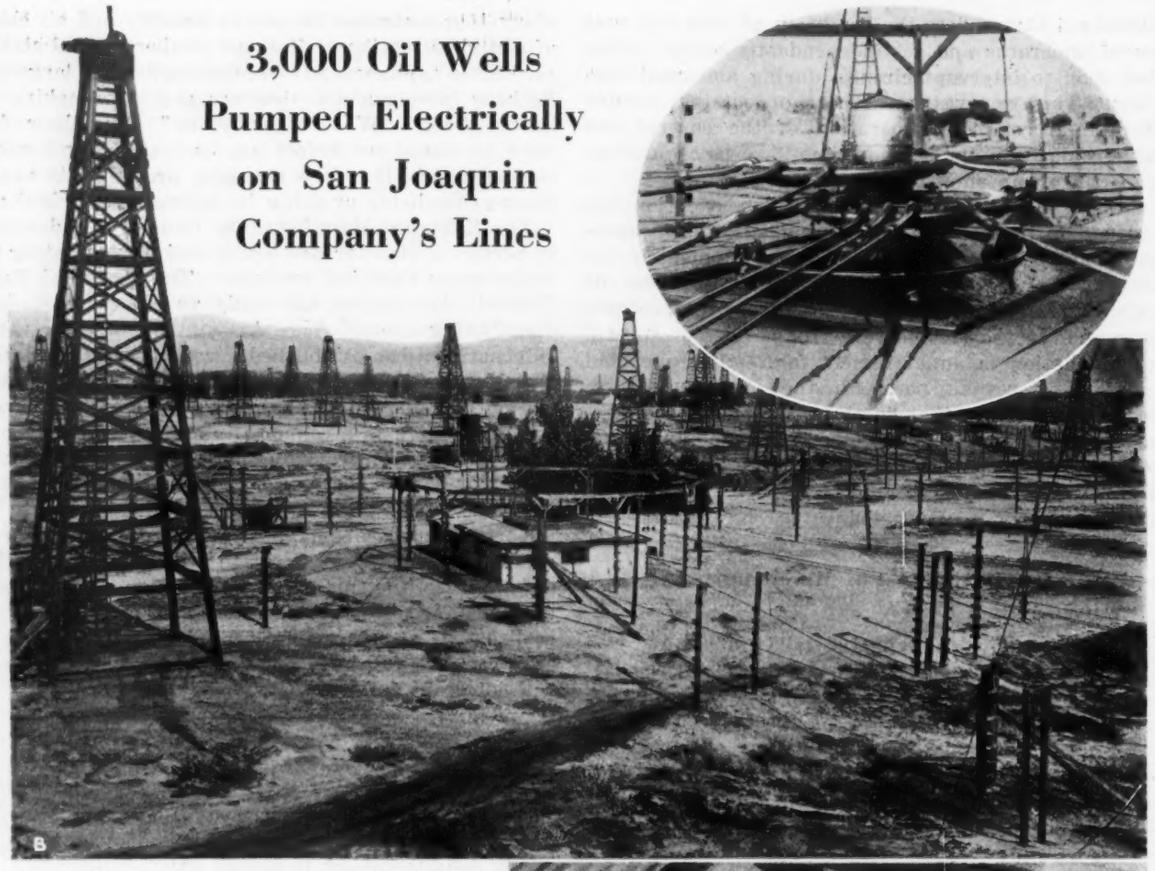
The Electrical Manufacturers' Council is endeavoring to perfect a plan for developing and disseminating cost statistics on electrical products. The Electrical Supply Jobbers' Association has made an elaborate study of distributing costs. The Association of Electragists International has established a cost system for dealers. The National Electric Light Association and the Association of Edison Illuminating Companies are showing concern. Here is a common interest, a common problem which the entire industry realizes must be solved sooner or later. These organizations could do no better work next year than to direct their leadership to this important purpose and make a concentrated effort to determine what it does cost to sell electrical merchandise. Meanwhile this general discussion of merchandising policies and costs is encouraging. It is making men realize that something must be done. But unless out of it comes a full knowledge of cost facts the industry will not profit much.

Typical Costs in Electrical Construction

ALTHOUGH reports on costs in various lines of electrical work are not uncommon, the facts are rarely definite enough to permit easy comparison. The paper by Campbell Higgins which we published last week is especially useful in that itemized labor costs are so reduced to a unit basis as to give very direct guidance to those having work in hand. The job from which the figures were taken was a big one—a group of modern concrete and steel industrial buildings, with something over forty acres in aggregate floor space, nearly 60 miles of conduit and other things in proportion. The work was evidently planned with much forethought and executed with the help of all labor-saving devices feasible. It was carried out in 1920 and 1921 and pushed at high speed, so that in most respects it may be taken as typical of the best recent practice. One of the striking features of the cost data is the relatively large amount of so-called unproductive labor—in results probably the most productive, showing the value of orderly and skillful administration in putting through the task.

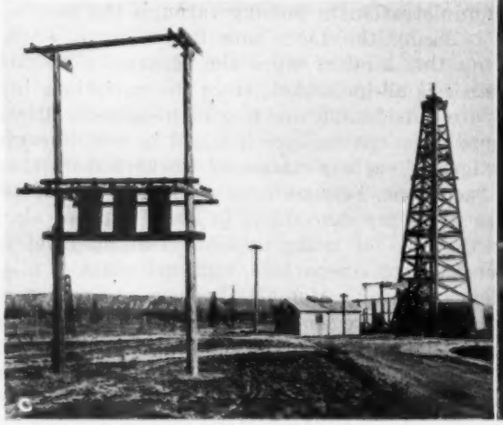
In bringing the facts into usable form when considering this kind of work the separation of material and labor is all-important, since the variations in these items are considerable and may be in opposite directions. For maximum convenience it might be well to segregate the wages of various classes of workers more than has here been done, because here again the pay of several groups may vary unevenly. In every class of electrical work the cost of units in labor and material is the proper basis of comparison, but each class is a special problem in classification. Data such as are here given—all too rare—are not only of great importance to constructors but furnish a full and decisive record of costs for the purpose of estimating reconstruction values and depreciation in the consideration of plants under examination as public utilities. Many an acrimonious quarrel would have been cut short had reliable cost data been available during the last twenty-five or thirty years.

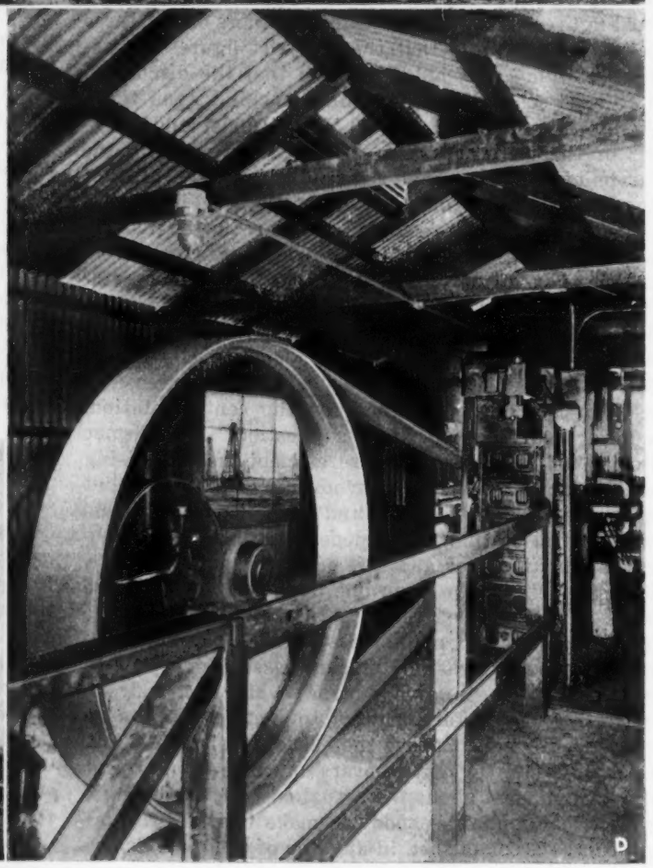
3,000 Oil Wells Pumped Electrically on San Joaquin Company's Lines



OWING to the greater economies effected, electric drive is rapidly displacing steam and gas engines for pumping the oil wells of California. On the lines of the San Joaquin Light & Power Corporation alone there are now 3,000 oil wells so operated. This is a particularly striking demonstration of the merits of electric operation in view of the fact that oil and gas are here available without transportation. The relative costs per day per well operating with electricity, gas engines and steam engines are $1, $2.16 and $5 respectively.

A typical electrically operated oil field is shown in B, with a closeup view of one of the motor-driven jacks operating twenty-seven wells in A. A typical transformer service is illustrated in C. D is a combination pumping and drilling plant, showing resistor stacks and control panels at the right.





Heat Flow in Armature Coils

A Physical Interpretation of the Heat Phenomena Occurring in Armature Coils and in the Core—The Influence of Iron and Copper Losses, Core Dimensions and Ventilation on Heating Shown in Graphical Form

By C. J. FECHHEIMER
Power Engineer Westinghouse Electric & Manufacturing Company

PERHAPS no problem which arises in the design of electrical machinery is more important or more difficult than that of temperature rise. It is important because too high temperature frequently results in eventual destruction of the insulation and too low temperature often means that the machine is more expensive than necessary. It is difficult for many reasons, such as the uncertainties of the constants of thermal conductivities of the insulation and of the steel laminations, of the rates at which heat is "picked up" by the moving streams of air, etc. It is especially difficult because the paths for heat conduction and for ventilation involve such intricacies that fundamental mathematical solutions are generally impossible. For any portion of the problem assumptions must be made, and usually some empirical data must be relied upon.

Difference in temperature between points in a given material gives rise to the flow of heat by conduction. In most electrical machinery nearly all of the heat is carried away by moving air, and the heat that is conducted away through the feet or other fastenings is nearly negligible. However, conduction does play a very important part in heat transmission within the apparatus. Conduction is the means whereby the large temperature differences are reduced. For example, were it not for the flow of heat by conduction through the insulating walls of armature coils the copper would reach infinitely high temperatures. Hence in the

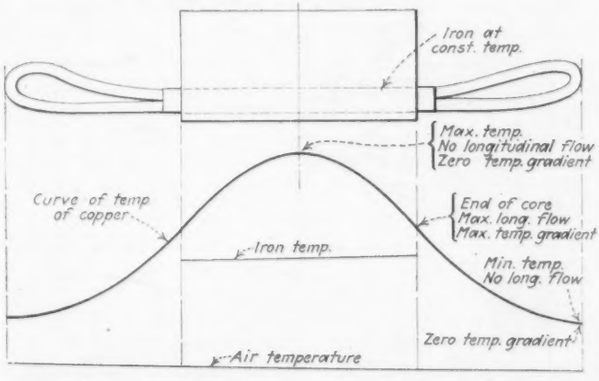


FIG. 1—LONGITUDINAL TEMPERATURE DISTRIBUTION

solution of any temperature problem in electrical machinery heat flow should receive proper consideration by designers and operators.

The quantity of heat which flows between two points is proportional to the difference in temperature (difference of thermal potential) and inversely proportional to the thermal resistance of the path—that is, Ohm's law for the heat circuit. The thermal resistance is directly proportional to the length and inversely to the area, just as in the electrical conductor. However, owing to the necessity of considering three dimensions and since the areas and lengths are usually not simple, the heat-conduction problem is fraught with great difficulties. To add to the complexity, the thermal conductivities of the materials are considerably greater with than across the layers, and the constants of conductivity frequently differ for corresponding parts within a given machine. Thus the transverse thermal conductivity of the insulating wrapper on coils is less than the longitudinal and may vary as much as 50 per cent for the

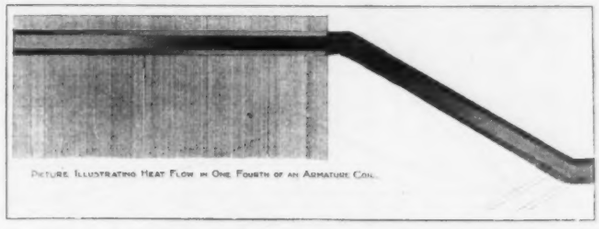


FIG. 2—A GREAT AMOUNT OF THE HEAT FLOWS LONGITUDINALLY TO THE END OF THE COIL, WHERE THE AIR REMOVES IT

armature coils in a given machine. The resistance to the flow of heat is known to be about fifty times as great perpendicular to the planes of the steel laminations as along them. Consequently, in any analytical solution it is necessary to make assumptions, and generally some part of the solution is empirical.

When a mathematical solution of a complicated phenomenon is obtained, the tendency is to lead one quite far from the physical conception of the relations of the quantities that enter. Since the physical picture assists materially toward a qualitative understanding of a phenomenon, interpretations are given in this article of the mathematical expressions contained in a paper entitled "Longitudinal and Transverse Heat Flow in Slot-Wound Armature Coils."* The importance of the subject will be recognized by all who are familiar with the fact that the machine having a short core is far easier to cool than one with a long core, owing largely to the influence of the longitudinal heat flow in the copper.

By longitudinal heat flow is meant the heat that is conducted along the copper in the coil from the embedded portion to the ends or vice versa, depending upon the relative rates of heat dissipation from the two. The transverse flow is the heat that is conducted across the wall of insulation for the embedded or end portion.

The physical picture is made clearer by regarding heat as a fluid and imagining a conductor of heat to be analogous to a channel for the fluid. The good conductor of heat such as copper offers relatively small resistance to the fluid flow, like a river in a long open channel; the poor conductor of heat, like the thin insulating

*A. I. E. E. *Transactions*, 1921, page 589.

walls, offers large resistance, somewhat analogous, except for thickness, to seepage of water through the soil. When heat is generated within a conductor it is analogous to supplying water from springs distributed along the river bottom.

In perhaps more than 50 per cent of the cases, the heat generated in the embedded copper by I^2R and eddy-current losses causes the copper to be at higher temperature than the iron. Considering that case, some of

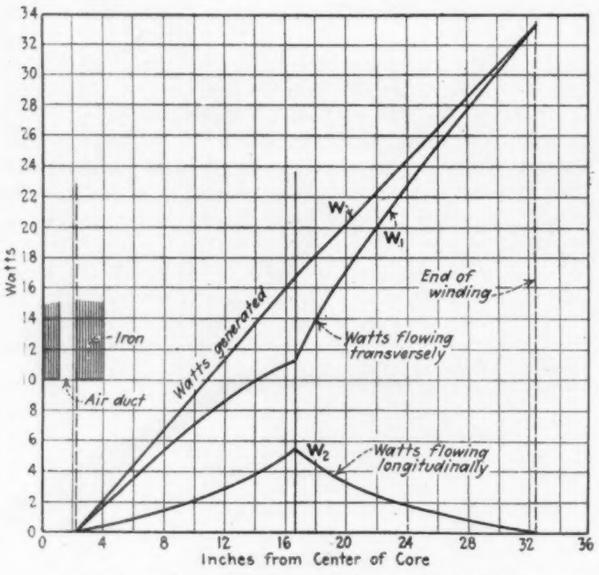


FIG. 3—TOTAL WATTS GENERATED AND FLOWING AT ANY POINT

that generated heat is conducted transversely through the insulating wall to the cooler iron in the core and the remainder of that heat must flow longitudinally along the copper. The coil ends are cooled by air streams at a relatively rapid rate, so that the copper there is cooler than that which is embedded; consequently heat flows from the copper in the embedded parts to the copper in the ends. Just as in the case of the river fed by springs, the quantity of flow along the channel (copper) increases the farther one goes down stream; the total longitudinal flow is the summation of all that portion of the water fed from the springs (or heat generated) that has been added from the beginning up to that point. Meanwhile, water is seeping away (the transverse flow through the insulating wall) all the way along. If the flow longitudinally is confined within a constant section of channel, the velocity, and therefore the pressure drop, increase as the quantity of flow increases. Similarly, in the embedded part of the coil, the quantity of longitudinal flow continually increases as the ends are approached, and therefore the fall of potential—that is, the drop in temperature—continually increases. As the copper temperature decreases the transverse flow must necessarily decrease. As the transverse flow decreases a larger percentage of the generated heat per inch of length must be conducted longitudinally, and that means that the longitudinal temperature drop per inch of length (temperature gradient) must increase, and so on. Consequently the temperature longitudinally diminishes at an ever-increasing rate until the end of the core is reached. The curve for copper temperature (Fig. 1) will help to clarify the picture, being a maximum at the center.

Considering the total quantity of heat as flux, there is evidently a maximum density of heat flux in the copper at the end of the core as up to that point all of that generated heat in the copper which was "picked up" for longitudinal transmission has collected and must pass through the copper at the end of the core. The temperature gradient (slope of the temperature curve in Fig. 1) is consequently maximum there.

With the beginning of the well-ventilated end windings, just beyond the end of the core, and their consequently relatively low surface temperatures, the transverse thermal drop is suddenly augmented, and the resultant density of transverse heat-flow flux increases to a maximum. The falling off in copper temperatures from the end of the core to the extreme end of the winding is accompanied by a diminishing rate of transverse heat flow.

It will be remembered that there was high heat flux density in the copper at the end of the core due to longitudinal flow from the embedded part. This is gradually converted in the end windings to transverse flow, and all of it must be thus transmitted between the end of the core and the extreme end of the winding. To that longitudinal heat which is converted to transverse in the end windings must be added the heat generated by I^2R and eddy currents in the copper in the ends, and all must be dissipated from the ends. The longitudinal heat flux density diminishes as the extremity of the ends is approached; therefore the temperature gradient diminishes, as will be seen in Fig. 1.

The physical picture is made clearer by an inspection of Fig. 2, which shows by shading the intensity (or density) of heat flux. Thus the density of transverse flow has two maxima—at the center of the core and at the beginning of the ends adjacent to the core. There are likewise two minima—in the embedded part at the end of the core and at the extremity of the ends.

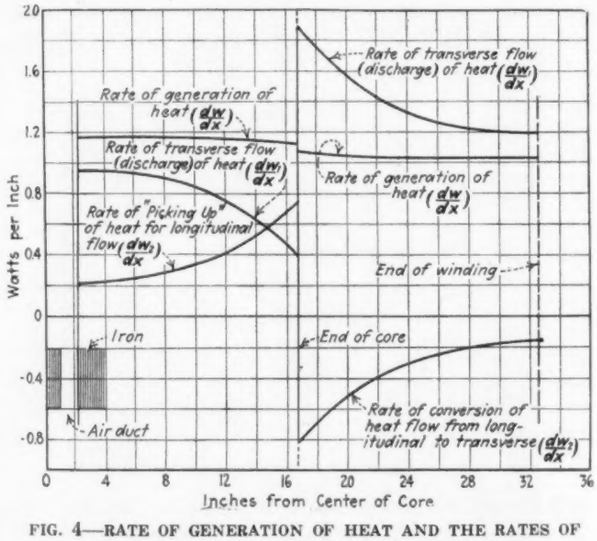

Watts per Inch
Inches from Center of Core
Rate of generation of heat $(\frac{dW}{dx})$
Rate of transverse flow (discharge) of heat $(\frac{dW_1}{dx})$
Rate of "Picking Up" of heat for longitudinal flow $(\frac{dW_2}{dx})$
Rate of transverse flow (discharge) of heat $(\frac{dW_1}{dx})$
Rate of generation of heat $(\frac{dW}{dx})$
End of winding
Iron
Air duct
End of core
Rate of conversion of heat flow from longitudinal to transverse $(\frac{dW_2}{dx})$

FIG. 4—RATE OF GENERATION OF HEAT AND THE RATES OF DISCHARGE AND "PICKING UP" OF HEAT

The longitudinal flow is zero at the middle of the core and at the extremity of the ends and is maximum at the end of core.

In Fig. 3 numerical values are plotted for a particular turbo-alternator and should further assist in understanding the phenomenon shown qualitatively in Fig. 2. (The end of the air duct is taken as the point of

maximum temperature.) The unit chosen is the watt, which is the same kind of unit as the British thermal unit per second.* At any value of abscissa the total watts generated equals the sum of the watts flowing longitudinally and transversely; for example, at the end of the core, 16.72 = 5.4 + 11.32. In Fig. 3 the ordinates represent the summation of heat from $X = 0$ (the end of the air duct) up to the particular point. This will be quite clear for the curves of watts generated and the transverse flow. For the longitudinal flow curve watts are continuously added up to the end of the core. From that point to the extremity of the winding the longitudinal heat received from the embedded part is gradually converted to transverse flow, and therefore the longitudinal flow gradually decreases and finally becomes zero at the extremity. In the case of the longitudinal flow the ordinates are a measure of the heat-flux density. For the transverse flow that statement does not apply.

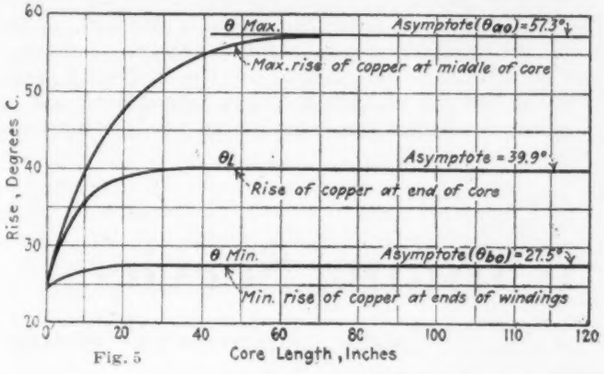


Fig. 5

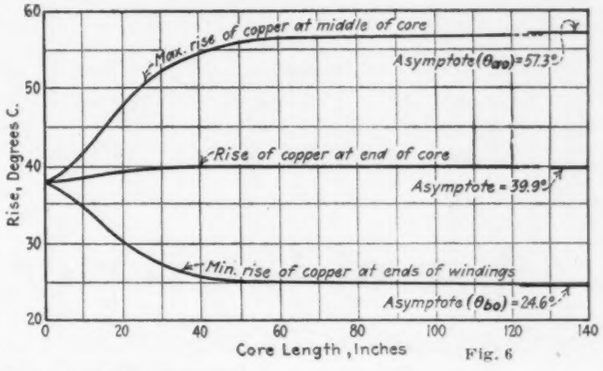

Max. rise of copper at middle of core
Asymptote(θao)=57.3°
Rise of copper at end of core
Asymptote = 39.9°
Min. rise of copper at ends of windings
Asymptote(θbo)=24.6°
Rise, Degrees C.
Core Length, Inches

Fig. 6

INFLUENCE OF CORE LENGTH UPON TEMPERATURE RISE

Fig. 5—Based on constant length of end windings. Fig. 6—Based on constant ratio of length of ends to embedded parts.

It is interesting to note the changes in the slopes of the curves in Fig. 3 and the meaning thereof. They are given in Fig. 4. The slope of the "watts-generated" curve gives the watts per inch of length; that is, the ordinary I^2R and eddy-current losses per unit length. Were it not for the influence of temperature upon resistance and the sudden decrease in eddy-current loss at the end of the core, the generated watts per inch would be constant. The influence of those two factors in causing the generated loss per inch to depart from a constant value will be seen from an inspection of Fig. 4.

The slopes of the transverse heat-flow curve in Fig. 3 (as plotted in Fig. 4) are the transverse watts per inch of length; that is, the ordinates indicate the density of transverse heat flux. That density decreases from the left to the right end, because the copper temperature decreases (see Fig. 1) and therefore the temperature difference between the copper and the iron decreases up to the end of the core. Then, as previously explained, the transverse flow suddenly increases. As the copper temperatures in the ends decrease as the extremity is approached, the transverse drop, and therefore the transverse flow per inch likewise decreases. That rate of transverse flow is evidently the rate of discharge of heat.

The meaning of the slope of the longitudinal flow curve in Fig. 3, as plotted in Fig. 4, is, for the embedded part, the heat per inch that is "picked up" for longitudinal transmission. For the ends it means the watts per inch of longitudinal flow that are converted from longitudinal to transverse flow.

Referring to the temperature curve in Fig. 1, it will be seen that as the temperature difference betwen the copper and the iron decreases the rate of transverse flow must dcrease. That in turn means that more of the generated heat must be transmitted longitudinally; consequently the rate of "picking up" of heat for longitudinal transmission must increase. As a result there is more rapid decrease in copper temperature, which causes a faster lowering in the rate of transverse flow. That again causes a larger percentage of heat to flow longitudinally, and so on. For the ends, as the difference between the copper and the air temperature decreases, the transverse flow per inch must correspondingly decrease. Some of the longitudinal heat is converted to transverse, thereby decreasing the density of heat flux in the copper and decreasing the temperature gradient along the copper. The ordinates of the rate of longitudinal conversion curve (for the ends) are shown as negative, because now heat is to be discharged (transversely) instead of accumulated, as for the embedded part.

For any value of abscissa the rate of generation of heat equals the rate of transverse flow plus the rate of "picking up" for longitudinal flow, or conversion from longitudinal flow. The differential equation in the mathematical derivation, when simplified, is simply a short-hand expression for this statement. Thus a physical picture of the differential equations has been drawn.

A point of interest is that the longitudinal flow is only a means for diminishing the differences in temperature along the copper. It provides no means for the escape of heat from the copper. In many machines, however, it is the means whereby the so-called "hot spot" is liminated. Thus, in short-core machines, with well-ventilated ends and with large eddy-current loss in the embedded copper, the longitudinal flow reduces the maximum copper temperature considerably below that which would obtain with only transverse flow. In fact, there are cases of short-core machines in which the iron temperature is higher than that of the embedded copper.† Then there is transverse flow from the iron to the copper. The heat thus received plus the heat generated in the copper flows longitudinally to the ends, and there all of that heat plus the heat generated

*It should be noted that the conditions are for the steady state only, which means also steady flow of heat; therefore the watt may be considered as the unit instead of the joule or B.t.u. or calorie.

†This condition also obtains in many machines operated at light loads.

in the ends flows transversely to the external coil surfaces, where it is carried away by moving air. As another example, in the case of certain direct-current railway motors the ends were very poorly ventilated—to avoid the collection of dirt—and then the heat generated in the end windings was only partly dissipated from the coil-end surfaces. The remainder flowed longitudinally to the embedded part, where it, plus the generated heat, flowed transversely to the cooler iron.

It will readily be seen from foregoing explanations why the difference between the maximum and minimum copper temperatures increases rapidly as the core length is increased. For any given proportions of shape of slot, current density, ventilation constants, thickness of insulation, etc., the influence of core length upon temperature will differ. The same turbo-alternator for which Figs. 3 and 4 were plotted was selected for the curves in Figs. 5 and 6, and they illustrate the influence of core length. In both are shown the copper temperatures near the center of the core (maximum), near the end of the winding (minimum) and at the end of the core. In Fig. 5 they are drawn for constant length of ends. In Fig. 6 the ratio of the length of the ends to the embedded part has been taken to be constant. The shapes of the curves for the two cases are different, but in both the maximum temperature (for a core of infinite length) is the same, as all generated heat at the center flows transversely. For the minimum temperature the longitudinal flow influences that at the extreme ends, with constant (finite) length. When the ratio of length of ends to embedded parts is constant, as the embedded parts approach infinite length, the ends must do so likewise; consequently at the extremity longitudinal flow has no influence upon temperature, and all the heat must flow transversely, the result being lower temperature there.

Use of Converter in Mining Service

Former Apprehension Had Basis, but Recent Developments, Chiefly the Introduction of High-Reluctance Magnetic Circuit, High-Speed Breakers and Automatic Substations, Have Changed the Situation

By J. L. McK. YARDLEY
General Engineer Westinghouse Electric & Manufacturing Company

SYNCHRONOUS converters have apparently given satisfaction in the comparatively small number of mining installations in which they have been employed for the conversion of alternating current into direct current, yet it is a fact that in the great majority of mining installations motor-generator sets only have continued to be employed for this purpose. Such a situation can only be the result of a marked preference for one type of equipment over the other. This preference cannot be due to difference in costs, since the cost of both installations is practically the same. Complete mining units to operate from a 2,200-volt, 60-cycle supply circuit, whether motor-generator sets or synchronous converters, may be obtained at the present time at approximately the following figures: 100-kw. unit, $4,000; 150-kw. unit, $4,400; 200-kw. unit, $5,200; 300-kw. unit, $6,300.

The preference for motor-generator sets seems to be the result of a belief which has developed through experience that they are the most reliable and economical type of equipment obtainable for operation under the service conditions existing in mines, where extreme load variations occur and coincidentally big voltage drops. The preference has, of course, had a basis. It is that the frequency of dead grounds and dead short circuits and other high instantaneous overloads has been greater in mining service than in any other industrial service, or even in the usual electric railway service. These conditions tended to produce an overload which greatly exceeded the normal capacity of the equipment because the converting unit is usually small. Owing to the fact that the insulating clearances and spacing factors have been smaller in the small units than in the large, the ability to withstand flashovers without excessive destructive burning has been weak. Hence mining engineers have been entirely logical in not following the growing tendency of engineers in other industries to use converters.

However, some comparatively recent developments have been made in the design and operation of the synchronous converter that make it opportune at the present time to consider the application of this type of equipment to mining service more seriously than ever before. Reference is made particularly to the introduction of comparatively high reluctance in the magnetic circuit of the commuting poles of synchronous converters. Then there is also the possible use of higher-speed direct-current circuit breakers and of automatic substations for the greater protection as well as more economical operation of synchronous converters. Comparatively little can be said that is new regarding the fundamental requirements of mining service. This subject has been quite thoroughly analyzed in the past, and the various merits and disadvantages of the types of equipments which may be employed have become well understood. The principal fundamental argument remains about the same, namely, that the synchronous-converter-transformer installation is inherently more efficient than the motor-generator installation. This difference amounts to from 3½ to 9½ per cent for the sizes of units employed and the load factors ordinarily experienced in mining service. The saving which this difference in efficiency represents has been well worth striving to attain, and naturally efforts have been expanded to make the synchronous-converter transformer installation meet all the requirements.

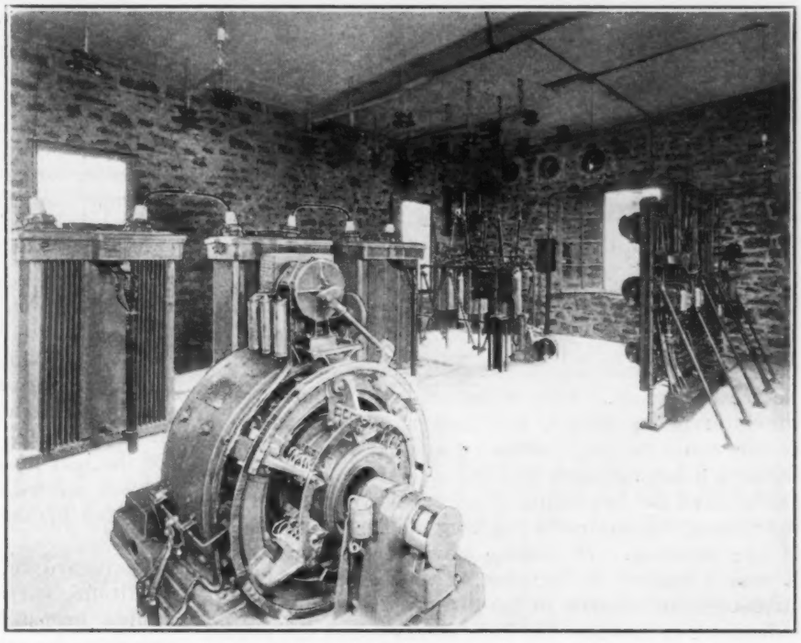
Contrary to rather general impressions, the development and success of the commutating-pole synchronous converter required only a short interval of time. All the advantages of the new type of design were practically obtained in one jump. The first high-speed com-

mutating-pole synchronous converter* was 100 per cent higher in speed than the non-commutating-pole type of machine it superseded, and it embodies all the advantages of increased efficiency, reduced weight and cost and improved general performance which were found to accompany the new type of design.

For 60 cycles, it is true, the full advantages of the commutating-pole design were not at once obtained. There was a rather general apprehension that the 60-cycle machine would flash worse with commutating poles than without. Owing to this hesitation, the first 60-cycle synchronous converter equipped with commutating poles was an old design which had been successful in operation without commutating poles. This machine was scarcely improved by the addition of commutating poles, but gave promise of the results which might be expected at 60 cycles from good commutating-pole design; so that by 1914† the manufacturer of synchronous converters was entirely on a commutating-pole basis, both for 25-cycle and for 60-cycle service. It is important to appreciate, therefore, in considering the matter of reliability, that the synchronous converter has been developed substantially as at present for a period of years approaching, if not equaling, that of the modern motor-generator set.

A number of small synchronous converters were designed for general industrial service back in 1914, but of ratings which also meet the usual conditions of mining service. These machines, rated at 100, 150, 200 and 300 kw., 275 volts, 60 cycles and 1,200 r.p.m., were in the main very satisfactory. They were amply rated for general industrial service, as they would carry 25 per cent overload for two hours and would comfortably carry momentary overloads of 100 per cent. However, when considered for mining service, owing to the comparatively large amounts of power which would usually be behind them and the frequent instantaneous loads far in excess of their capacity to which they would be subjected, these machines were not generally favored under conditions in which practically their only protection would have been their own limited amount of resistance and inductance and the then usual comparatively slow-acting types of substation switching equipment. In fact, when tested out under such conditions, the flashovers which occurred tended to result in considerable destructive burning.

The high-reluctance commutating pole has increased by about 100 per cent the ability of the synchronous converter to operate without flashover under momentary overload conditions. The increase in the instantaneous load capacity of these machines from 200 per cent to around 400 per cent of rating by means of high-reluctance commutating poles seems likely to bring the synchronous converter to such a position of reliability, in the opinion of practical mining men, as to cause them to avail themselves to a greater extent of its economies. As already mentioned, the use of higher-speed direct-current circuit breakers or the advantages of automatic substation operation will probably also influence the situation. It should also be mentioned that details of construction and insulation clearances have been modified on these small machines so that flashovers do not cause the same amount of destructive burning. The earlier design tended to confine the arcing so as to burn the brushes and brush rigging very badly, but the later design is much more open, does not restrict the arc, and in fact tends to assist it to dissipate without excessive burning of the machine itself.



EXCAVATION FOR THIS 300-KW. AUTOMATIC CONVERTER STATION COULD BE REDUCED TO 150 YARDS FOR MINE SERVICE

This is a 600-volt, 60-cycle commutating-pole synchronous-converter station serving an electric railway. In the foreground is the converter with automatic brush-lifting equipment and thermal relay on the bearing. To the right is the control panel carrying contactors, relays and meters.

Although the effect of high reluctance in commutating-pole circuits was fully understood back in 1914 and was being considered for use in booster-type synchronous converters, there was no attempt to employ this feature for the purpose of increasing the instantaneous overload capacity in any of the earlier commutating-pole machines. Commutating poles and windings were introduced primarily to meet normal operating conditions in general industrial and railway service. They were proportioned to compensate for armature reaction and provide necessary commutating flux under such conditions, and, as has been mentioned, they resulted in decidedly better performances. The commercial value of increasing the reluctance in the magnetic circuit of the commutating pole and increasing the strength of the commutating-pole winding so as more nearly to compensate the armature reaction under instantaneous load conditions was not appreciated. This is mentioned because it is rather surprising, particularly in view of the fact that the need for greater protection for synchronous-converter installations under instantaneous

*This machine, a 1,500-kw., 600-volt, 25-cycle, 500-r.p.m. synchronous converter, designed and built in the early part of 1911, was described and illustrated by the author in the *Electric Journal*, August, 1912, pages 704 and 705.

†An article on "High-Speed Rotary Converters" by the author in the *Electric Journal*, October, 1914, gave details of the general results which had been accomplished at that time.

load conditions was recognized and efforts were being made to develop protection by one means or another.

Most of the efforts to secure greatest continuity of service and safety for the converting equipment were along the line of developing the relative assistance of various auxiliaries. One of the most promising of these was a higher-speed direct-current circuit breaker. It was appreciated that there is an interval of delay in the application of an overload, however great, to an electrical machine, owing to the inherent inductance of the intervening circuit, and that a synchronous converter would be fully protected against flashover if it could be disconnected from the load circuit in the interval between the beginning of an excessive overload and the time of the overload's reaching the flashover capacity of the machine. It became obvious that practically it was a matter of introducing an inductance and a quick-opening breaker in the direct-current circuit, the inductance to increase the time interval and the circuit breaker to take advantage of that interval and automatically open the circuit. Some very satisfactory tests were made‡ using an inductance of approximately 15.25 milli-henries and a higher-speed circuit breaker in connection with a 500-kw., 1,250-volt, 60-cycle non-commutating-pole synchronous converter. However, difficulty was experienced in obtaining a circuit breaker with a time element less than 0.015 second, whereas it was demonstrated that a time element of 0.01 second or less would be necessary in order to permit the use of a comparatively inexpensive inductance. The combination of circuit breaker and inductance limited the current to around 1,400 amp., or three and one-half times normal.

TABLE I—TYPICAL ECONOMIES IN RAILWAY SERVICE

Headway between cars	1 hour
Length of line (single-track 70-lb. rails), miles	25
Number of substations	3
Capacity of substations, kw.	300
Size of trolley	0000
Size of feeder, circ.mil	300,000
Distance between substations, miles	10
Schedule speed, miles per hour	25
Length of operating day, hours	20
Total substation hours (manual operation)	60
Total substation hours (automatic operation)	34
Running light loss per station, kw.	15
Energy saved per day with automatic operation, kw.-hr.	390
Energy saved per year at 1 cent per kw.-hr.	$1,424
Labor saving per year, six operators at $90 per month	6,480
Investment in converting units exclusive of switchboards	20,500
Investment in automatic control, three stations	21,000
Maintenance, interest, insurance, depreciation taxes (15 per cent)	3,150
Cost of inspection per year	900
Total annual charges	4,050
Net saving	3,854
Net return on investment in automatic equipment, + per cent	18.3

Since that time a 1,200-amp. direct-current circuit breaker has been developed which, when tested in connection with a 500-kw., 600-volt, 60-cycle, 1,200-r.p.m. synchronous converter, equipped with high-reluctance commutating poles, under short-circuit conditions, limited the current to 6,000 amp.—that is, 7.2 times normal—in 0.005 second and entirely cleared the circuit in 0.0085 second. The inductance in circuit was only 0.15 milli-henry, or, taking into account the different current capacity, the inductance coil employed was only about 20 per cent of the size employed in 1914.

It has been established, therefore, that by means of comparatively inexpensive equipment a synchronous converter or direct-current generator can be absolutely protected against being flashed over by direct-current load conditions. Now, if this protection should be combined with the automatic substation so as to eliminate the human element introduced by the station operator, nearly all the objections raised against synchronous converters in mining service would be removed. Of course, the automatic substation‖ can be and is being used in connection with motor generator sets in mining service.

The remaining objection to synchronous converters is due to the rather meager amounts of copper strung in the alternating-current and direct-current feeders. The claim is that voltage is not held up so well and that as a consequence work slows up in the workings remote from the power station. Since the compound-wound synchronous converter will take care of direct-current feeder drop within reasonable limits as well as it is taken care of by the motor-generator set, the answer to this objection would seem to be that some of the efficiency to be obtained through increasing size of feeders, reducing feeder losses and employing synchronous converters should be capitalized and the capital invested in increased copper in the alternating-current feeders, with probably some additional investment also in the direct-current feeders. In this respect the problem in mining service does not seem to be materially different from the problem in connection with the surface railway. Perhaps, at least in coal mining, more of the mining substations in the future will be placed on the surface instead of underground. At any rate, the need of sufficient copper in the feeders for the sake of economy has been appreciated in electric railway service, and this need has been met and service benefited by the automatic synchronous-converter substation.

In regard to costs and the savings to be effected, conditions vary to such an extent in the individual mining properties that a general statement, however approximate, can scarcely be made. Figures are given here, however (Table I), on a typical example of a suburban electric railway, simply to show the various points which should be considered in calculations made to justify installing automatic substations.

Possibly in attempting to derive figures which would represent at least some mining service conditions a conservative assumption would be that all substations would be operating continuously six days per week at around 30 per cent load factor, so that there would be no saving of light-load running losses. Probably also a somewhat less completely automatic form of automatic substation§ would be satisfactory inasmuch as it would save attendance, give protection to the equipment and would not cost more than half the figure used in the above table. In such an installation 6 per cent of the total kilowatt-hours supplied to the converting equipment would be an approximate figure to represent the saving effected by employing synchronous converters instead of motor-generator sets. The typical economies then would be those indicated in Table II.

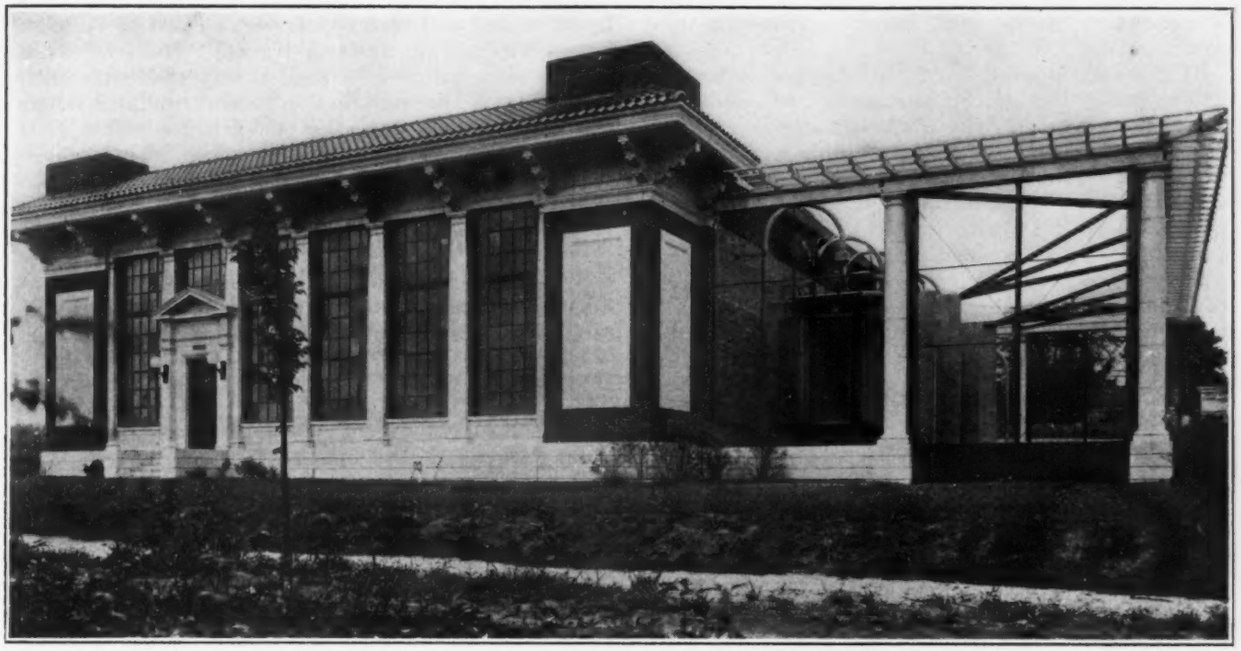
TABLE II—ESTIMATED ECONOMIES IN MINING SERVICE

Energy saved per year, automatic operation	0
Yearly saving through using synchronous converters instead of motor-generator sets: 30 per cent × 310 × 24 × 3 × 300 × 0.06 × 0.01	$1,200
Labor saving per year, six operators at $90 per month	6,480
Investment in converting units without switchboards	20,500
Investment in automatic control equipment, three stations	10,500
Maintenance, insurance, interest, depreciation, taxes (20 per cent)	2,100
Cost of inspection per year	900
Total annual charges	3,000
Net saving	4,680
Net return on investment in automatic equipment, + per cent	44.5
Per cent saving due to rotary converters	11.4

‡*Proceedings A. I. E. E.*, Oct. 9, 1914, "Use of Reactance with Synchronous Converters," page 1521, J. L. McK. Yardley.

‖A description of such equipment recently developed is given in the *Engineering and Mining Journal*, Oct. 8, 1921, page 599.

§*Mining and Metallurgy*, September, 1921, page 44.



Automatic Control of A.-C. Distribution

Operating Features of the Kansas City Power & Light Company's New Self-Operating Substation Recently Placed in Service in the Big Western Missouri City

By A. E. BETTIS* and C. W. PLACE†

THE increased use of electrical appliances in the home, the introduction of motion-picture theaters in the residence districts and the increased use of electric drive, heating and lighting in factories have in recent years changed the problem of supplying energy to large cities. Load growth now seems to be around centers, with all the characteristics of medium-sized cities surrounded by outlying zones which merge into adjacent zones. The problem of supplying these various centers and their surrounding zones is of exactly the same nature as supplying a group of small cities spread through a large countryside, and it looks most economical at present to treat the power supply in exactly the same way as if these centers were separated by considerable distances.

This situation has led to dividing the larger cities into zones, each operating company figuring out the economic size of the zone and building the distribution accordingly. This process was started in Kansas City about four years ago, the first step being to equip the inner group of such zones with transforming and distributing facilities. These stations were installed as hand-operated stations and were immediately loaded up to their capacity. It then became necessary to begin

*Superintendent of Construction and Engineering, Kansas City Power & Light Company.
†Engineering Department, General Electric Company.

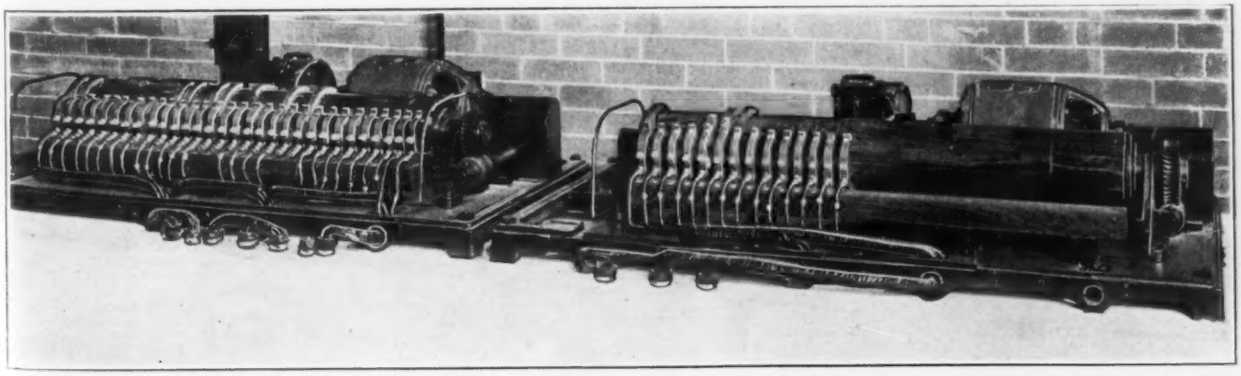


FIG. 1—MASTER CONTROLLERS FOR AUTOMATIC OPERATION. LEFT, FOR 13,200-VOLT PRIMARY SWITCH CONTROL. RIGHT, FOR 4,000-VOLT FEEDER CONTROL

the equipment of the next group surrounding these inner zones.

After a careful analysis of the situation it was decided to install two additional stations and so to equip them that they would operate without attendants. Following out its policy of doing everything within reason to assure continuity of service, the Kansas City Power & Light Company decided that the natural step in operation was to do away with as many chances of human error and misunderstanding, or inattention to business, as possible.

To the previous stations had been brought a double equipment of high-tension cables, frequently over different routes, and reserve sets which could be switched into service during times of trouble. The low-tension feeders were grouped in such a way that with their connection to the high-tension feeders radial distribution was obtained from the power house. This gives the least interruption to the customer when troubles occur on circuits other than the one feeding the particular customer.

TIME SAVED IN RECONNECTING

By making the new stations automatic and at the same time following the established main circuit connections it was felt that reconnections and rearrange-

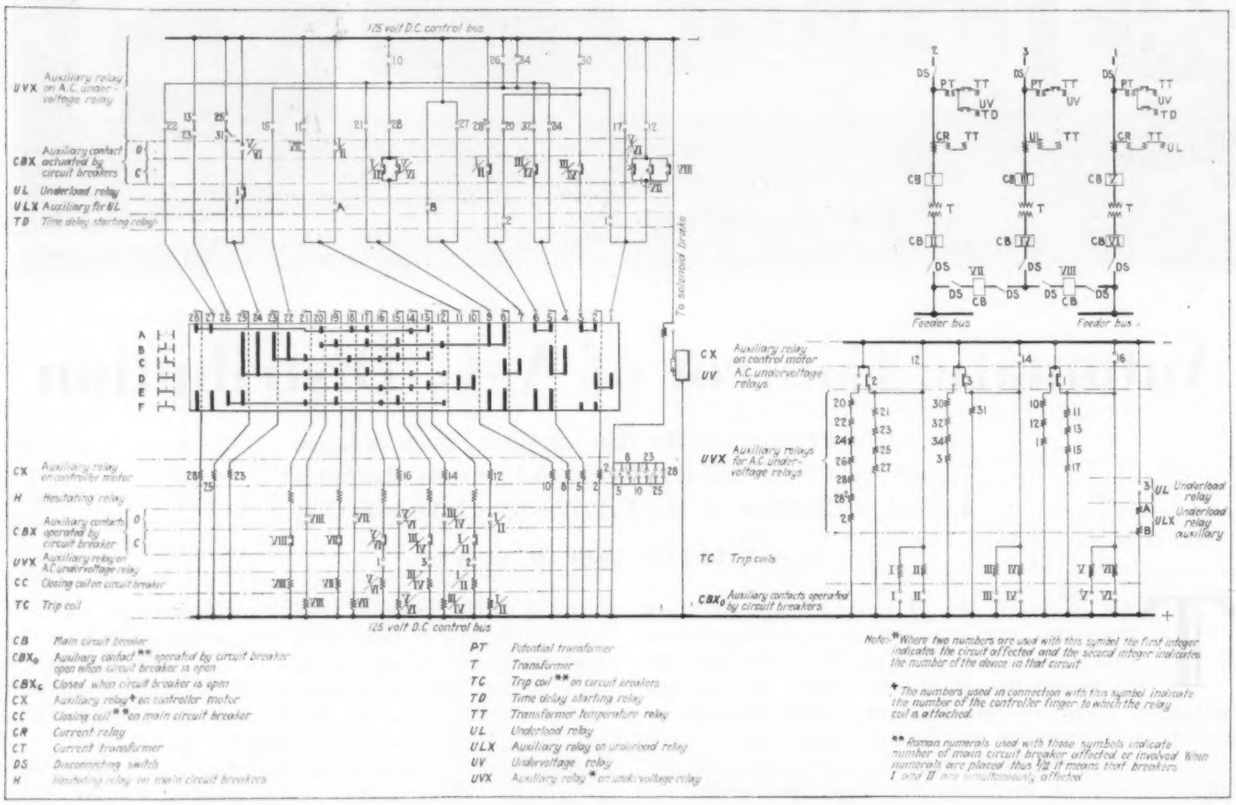

125 volt D.C. control bus
UVX Auxiliary relay on A.C. under-voltage relay
CBX Auxiliary contact actuated by circuit breakers
UL Underload relay
ULX Auxiliary for UL
TD Time delay starting relay
To solenoid brake
Feeder bus
Feeder bus
CX Auxiliary relay on control motor
UV A.C. undervoltage relays
UVX Auxiliary relays for A.C. under-voltage relays
UL Underload relay
ULX Underload relay auxiliary
CX Auxiliary relay on controller motor
H Hesitating relay
CBX Auxiliary contacts operated by circuit breaker
UVX Auxiliary relay on A.C. undervoltage relay
CC Closing coil on circuit breaker
TC Trip coil
TC Trip coils
CBX0 Auxiliary contacts operated by circuit breakers
125 volt D.C. control bus
CB Main circuit breaker
CBX0 Auxiliary contact** operated by circuit breaker open when circuit breaker is open
CBXc Closed when circuit breaker is open
CX Auxiliary relay* on controller motor
CC Closing coil** on main circuit breaker
CR Current relay
CT Current transformer
DS Disconnecting switch
H Hesitating relay on main circuit breakers
PT Potential transformer
T Transformer
TC Trip coil** on circuit breakers
TD Time delay starting relay
TT Transformer temperature relay
UL Underload relay
ULX Auxiliary relay on underload relay
UV Undervoltage relay
UVX Auxiliary relay* on undervoltage relay
Note:* Where two numbers are used with this symbol the first integer indicates the circuit affected and the second integer indicates the number of the device in that circuit.
* The numbers used in connection with this symbol indicate the number of the controller finger to which the relay coil is attached.
** Roman numerals used with these symbols indicate number of main circuit breaker affected or involved. When numerals are placed thus V/VI it means that breakers I and II are simultaneously affected.

FIG. 2—SIMPLE LAYOUT MADE POSSIBLE WITH AUTOMATIC CONTROL

During the peak lines Nos. 1 and 2, with the transformer for each, are feeding independently their groups of feeder circuits. The controller will be in position *A*. On the decrease of the load it is the intention to take off one bank of transformers while the other is to carry the whole load. This is accomplished by a contact-making ammeter on line No. 1, making contact at a predetermined low-current setting, and when this contact is made, energizing the motor driving the controller which moves the controller drum from position *A* to position *D*. As the segments on the drum come in contact with the fingers as position *D* is approached, the various oil switches operate in the proper sequence so as to transfer the group of feeders being fed by line No. 2 to line No. 1 and disconnect line No. 2 and its transformer. When the load comes back to a point where line No. 2 should be reconnected, a different source of power for the controller driving the motor is given by the contact-making ammeter on line No. 1, making contact at a high current value and bringing the controller from position *D* around again to position *A* and throwing the proper oil switches. It will be noted that these various combinations cover all the combinations which can be legitimately required.

The sequence in obtaining two combinations is as follows: consider that from position *F*, the "off" position, because of a heavy load, the controller motor is energized to move the drum into position *A*. As the controller moves, segment 13 makes contact and energizes hesitating control relay *H* through the contacts of undervoltage relay *UVX2*, and the auxiliary switches CBX_cI/II of oil circuit breakers I and II. This closes breakers I and II of line 1. In the same way segment 17 makes contact and energizes relay *H* through the contacts of undervoltage relay *UVX-1* and the auxiliary switches CBX_cV/VI of oil circuit breakers V and VI, closing breakers V and VI. Segments 18 and 20 complete a circuit through the tripping coils *TCVII/VIII* of breakers VII and VIII, and open the bus-tie breakers VII and VIII. Segment 14 energizes relay *CX-14*, which completes the circuit through the tripping coils, *T.C.* III and IV, of breakers III and IV, opening these breakers. Thus lines 1 and 2 are connected directly to the two feeder buses.

As the controller continues to revolve, the circuit of segment 9 and of segment 6, which furnished the initial impulse through relay *CX-5*, to start the motor are broken through the opening of CBX_cI/II *V/VI*. The controller is then kept in motion by the circuits through segments 27 and 28, which energize relay *CX-28*.

Before the controller has run off the short segments of division *A*, segments 22, 23, 24 and 25 make contact. Segments 23 and 25 are connected through the coils of relays *CX-23* and *CX-25*, to the positive bus, but the circuit of 22 is broken by the relay *UVX-15*, an auxiliary of *UV-1*. If there is sufficient load on line 1 the circuit of segment 24 is opened by the action of underload relay *UL-1*. Therefore, when the fingers have run off all the short segments of division *A*, all the *CX* relays will be de-energized and controller will come to rest.

This leaves line 1 energizing the right-hand feeder bus through oil circuit breakers V and VI, and line 2 energizing the left-hand feeder bus through oil circuit breakers I and II. The bus tie breakers VII and VIII are open, and line 3 may or may not be energized.

With the station in position *A*, if the load decreases until one feeder can carry it all, the controller is moved to position *D*, as follows: The underload relay *UL-1* closes its contacts and completes the circuit through the CBX_oV/VI auxiliary switches of breakers V and VI to segment 24. Segment 23 completes the circuit through relay *CX-23* to start the controller motor, segments 22 and 9 being still de-energized. The controller moves to position *D*, where the short segments of division *D*, 21, 19, 17, 14 and 12, complete circuits that open oil circuit breakers I and II on line 2, and close bus tie breakers VII and VIII. This leaves the equipment in position *D*, where line 1 energizes the right-hand feeder bus through breakers V and VI, and also energizes the left-hand feeder bus through breakers V, VI, VII and VIII. The oil circuit breakers I, II, III and IV are open.

ments required by load changes and faults could be more readily made than by hand. For instance, the loss of power on one line would immediately change the load over to another line with only the lapse of an interval for clearing the first line. The outage with automatic operation would be exceedingly small as compared with hand operation. It was felt that when a transformer and a line were loaded to a point where additional capacity was required a second line could be brought on more promptly and with less interference to the voltage regulation than if this condition were left to be discovered by an operator and corrected after he had communicated with the load dispatcher.

On the low-tension distribution the individual circuits were to be handled so as to duplicate the present hand practice, but instead of waiting for the operator to arrive at the switch and reclose the feeder switch after it had opened, the automatic equipment would immediately put this reclosing into motion and thus save considerable time in restoring the service on individual circuits. While the kilowatt-hours gained by these various precautions will not be very great, still they will amount to something and the effect on the customer should be very good. Since the time of an outage will be measured in seconds before power is restored if the line is in condition to be energized after trouble, the uncertainty in the consumer's mind at the time of loss of power will be removed. Thus the psychological effect of line trouble on the customer will be entirely different from the effect where the hand-operated station is concerned.

One of these stations has just gone into operation, and since this is to all appearances a new departure in an engineering and economic way, it is thought that a general description of what it was intended to accomplish, the method of attack and some of the details of the equipment will be of general interest.

This particular station is in a fast-growing residential district and was consequently laid out with a view of conforming to the type of architecture which would probably surround it.

The general plan of the electrical equipment is to bring in two main high-tension transmission circuits from the central power station and one reserve or emergency circuit. Each main transmission line will feed its step-down transformer and a group of 4,000/2,300-volt, three-phase, four-wire feeder circuits, each single-phase feeder having its voltage regulator. Arrangements are made so that during the period of light loads this radial method of distribution will be continued, but one line and its transformer will be cut out after its group of distribution feeders is thrown over on the remaining line. Arrangements are also made so that in case of trouble on either of the main lines the group of distribution feeders will be thrown over to the spare line and its transformer energized. This spare line takes in every way the characteristics and receives the treatment of the line and transformer which it temporarily replaces. Since all of these operations are to be carried on without the assistance of an operator, the control devices necessarily take a different form from those usually found in a hand-operated lighting substation.

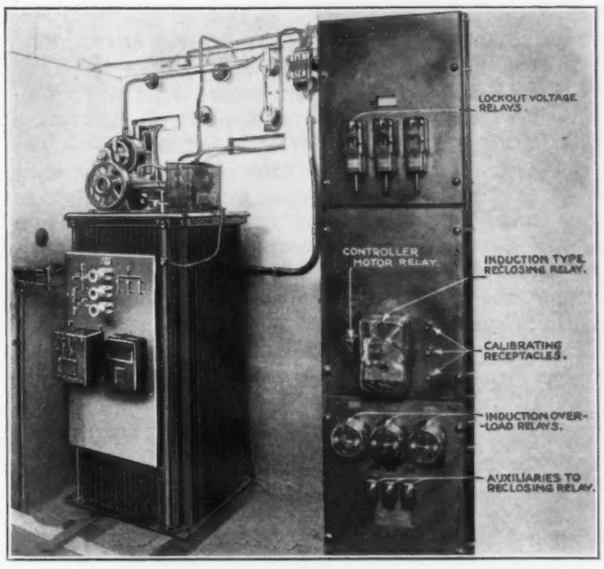


FIG. 4—INDIVIDUAL REGULATOR PANEL AND AUTOMATIC RECLOSING PANEL FOR THREE-PHASE, FOUR-WIRE, 4,000-VOLT CIRCUIT

The handling of the line and transformer connections and the tying and breaking of the two groups of feeder circuits are of particular interest. The general scheme is to arrange the connections so that service will not be interrupted during a change-over under

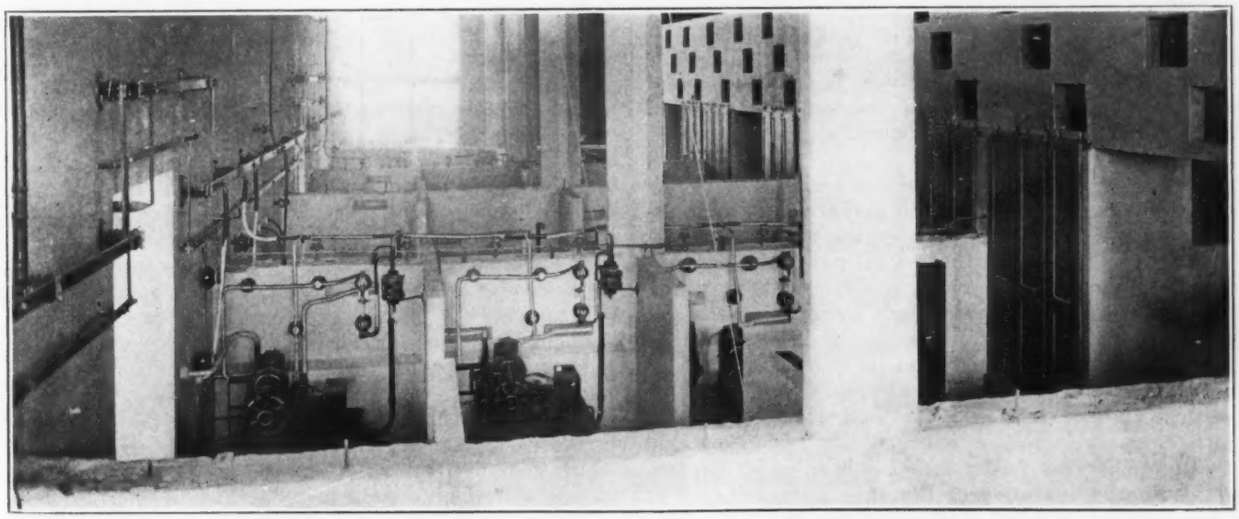


FIG. 3—REGULATOR ROOM, CONTAINING AUTOMATIC RECLOSING RELAY PANEL

normal operating conditions. In case of line or transformer trouble the load will be transferred immediately to the reserve equipment. This is accomplished by means of a motor-driven drum controller, the development of which will be noted at the left of the connections in Fig. 2. The controller closes and opens the various high-tension oil switches demanded for each set of conditions. The impulse for this controller to move from one position to another comes from the contact-making devices on the control board. These various impulses are independent of each other, and the action of the controller is such that it takes up a definite position for each condition.

The application of a drum controller to this type of service gives the greatest degree of flexibility in the

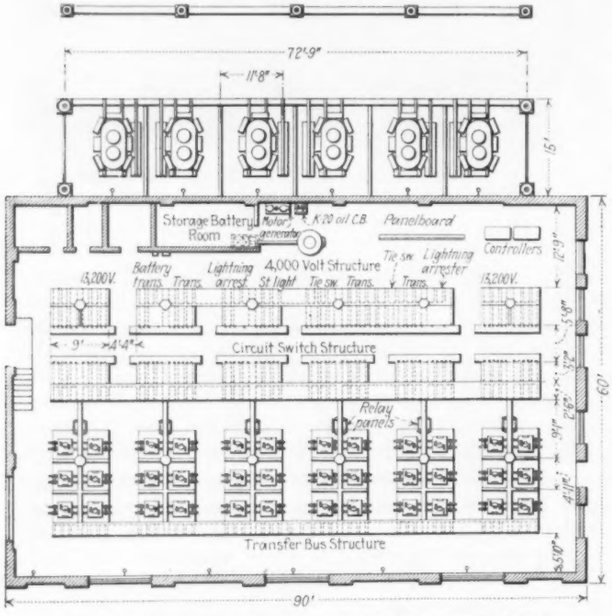


FIG. 5—ARRANGEMENT OF SUBSTATION EQUIPMENT

Transformers are indicated at the top of the drawing and feeder regulators in groups of six separated by barriers below.

operations which may be desired. The sequence of opening and closing of oil switches is definitely determined by the location of the segments on the controller. It is only necessary to determine what should be done, provide the impulse to move the controller to the proper position, and the oil-switch connection arrangement is effected as decided upon. This mechanical interlocking of the closing of switches through a drum controller allows the entire separation of the control circuits of the main switching equipment from the relays interpreting the conditions.

Each group of feeder circuits and equipment forming a three-phase group is separated by barriers from adjacent groups. Included in such groups are three feeder regulators, oil switches, the control panel and a group of compartments fed by a spur bus from the main bus. This group of three single-phase feeders is arranged so that the usual practice in keeping such circuits alive if possible is followed. That is, in case of opening of a single-phase feeder switch it is reclosed; if it again reopens, another trial is made, and should it open a third time, it is locked out and line conditions are investigated. This feeder group is handled by the control equipment indicated in Fig. 2.

This equipment is of interest in that first, the overload relay has a special time-current characteristic which corresponds very closely to the time-current characteristics of various distribution transformer protective fuses; second, it has a small timing controller which recloses the oil switches and locks out any one which is open after the third trial. This controller is made so that the time interval between closing can be varied most nearly to fit the operating characteristics desired on different types of circuits. Each of these feeder circuits is handled by a heavy oil switch, its rupturing capacity being greater than ordinarily found in similar hand-operated service because of the fact that this switch may be called upon to open a short circuit three times in succession before it is locked out. All of these oil switches are solenoid-operated from a storage battery. In order to keep down the size of this battery an additional controller was introduced so that only one of these feeder groups could come into action at any one time.

The general cost of this installation is not excessive when compared with the usual method of handling such stations if the same degree of isolation of feeders and circuits is accomplished. It will be noted that while there are certain control equipments to take the place of the operator, savings are effected in the amount of control wire, conduit indicating instruments and space which would not be possible if an operator was required to handle the station. With the method of control used, what appears to be quite a large number of circuits are not in reality complicated, since these circuits are practically all simple circuits. This is due to the fact that the drum controller physically does a large share of the interlocking by the location of the segments on the drum and makes it possible to use simple circuits, thus avoiding the chance interference of sneak circuits.

From all indications this type of station, properly proportioned to the weight of the service and the economical size for each community, is going to be a very popular type of equipment. It is felt that the little additional expense is warranted by the increased reliability in the service. With the connections maintained and the contacts in order, there will be no misunderstanding of load dispatcher's instructions or hesitation in throwing the switches which would correspond to the time taken by an operator in finding out what had happened, making a decision as to what he should do, getting in touch with the load dispatcher, receiving and executing his instructions. It is felt that the effect on the user of the power of this quick return of service aften an interruption will be decidedly beneficial.

This station represents a type of alternating-current automatic station which the authors believe will become very popular in large cities. For smaller groups the same general type of equipment is proving quite popular. The application of the principle to the maintenance of power on a single circuit is, of course, alike in high-tension equipment when the circuit is thrown over from a dead to a live line and in low-tension equipment when a switch is reclosed after an outage. This general practice most nearly fits the present-day distributing conditions because such a large proportion of the interruptions are due to temporary short circuits caused by accidents trifling in themselves or else are the result of lightning. In the latter case, if the switch is allowed to remain open a few seconds, the trouble which caused it to trip will have disappeared and the switch will then remain closed; thus the service can be maintained.

Russia's First Regional Power Station

Transmission Line 80 Miles Long and Operating at 110,000 Volts Is Completed Between Kashira and Moscow, Supplying the Soviet Capital with Energy Generated from Low-Grade Coal

By CHARLES P. STEINMETZ
Consulting Engineer General Electric Company

THE first regional power station designed and built in accordance with the comprehensive plan for Russian electrification drawn up for the Russian government by a committee of engineers came into being on June 11 last, when the Kashira central station began operation, transmitting electrical energy at 115,000 volts over a 130-km. (80.7-mile) line to Moscow.

Oil from Baku, 2,000 km. (1,240 miles) away, and anthracite and bituminous coal from the Donetz basin, 1,000 km. (620 miles) away, are the sources of fuel and power on which the city of Moscow has heretofore relied. Not far away, to the south of Moscow, however, lie extensive brown-coal deposits estimated at 8,000,000 tons. This is low-grade coal, of about 3,000 to 3,500 calories heating value and containing 40 per cent ash. It is soft and friable, and this, with its low caloric value and high ash, makes it unsuitable for long-distance transportation.

The Kashira station, which was built to burn this low-grade coal and transmit its energy electrically, is situated on the right bank of the River Oka, 7 km. (4.3 miles) below the Kashir Mountains, at the place where the railroad to Moscow connects with two branch railroads leading to Scopin and Bobrikow, the two main centers of the brown-coal deposits south of Moscow.

If Moscow were considered as the main market for electrical energy, then it might be more economical to place the Kashira station nearer to the supply of coal, but since in the future this station will have to supply the entire central industrial district, the location of the station in the center of the district is the best plan. With respect to Sepouchov, Podolsk, "the Lakes" and Kolomna the Kashira station occupies such a central position. The nearness to the Kashir River is also advantageous, the river supplying the station with water and furnishing a route for future shipments of fuel.

Railroad Cars Carry Coal to Boiler Room

The Kashira power house is connected with the railroad station by a branch line 5 km. (3 miles) long, which ends in front of the power house. The system of tracks includes several branches, one of which makes a loop, as is shown in Fig. 1, gradually rises and then crosses an estacade, permitting the cars laden with coal to enter directly into the boiler room for discharge into the bunkers. In the future bridge cranes and conveyors will be installed, but for the present use is made of pits. These simplify the work of unloading and conveying the coal, which is carried to the bunkers by a moving platform. All the auxiliary railways are to be electrified and the cars are to be moved by electric locomotives rated at 1,200 volts, direct current, with a truck having two axles, on each of which a 120-hp. motor will be mounted.

Fig. 1 shows the general plan of the central station. The office building is situated near the power house. Right above the station on a slope a workers' village is planned, and across the ravine beside the station will be the main village, in which it is planned to build a club house, a hospital, a school and other public buildings.

Wooden Pipe Used in Water Supply

As the electric station is on a high elevation with respect to the midsummer water level, it was necessary to build a pumping system on the shore of the river. Since in the spring the water rises very high on this part of the river, the pump house is built in the form of a tower, and it is also adapted for an ice-cutting plant. The pump house contains three 260-hp., three-phase, 50-cycle, 3,000-volt motor pumps, each having an output of 2,500 cu.m. (88,290 cu.ft.) per minute. In view of the present lack in Russia of a sufficient quantity of cast-iron piping, the water is conveyed in wooden piping held together by iron rings. The pipes have a diameter of 91 cm. (36 in.) and the wood is 50 mm. (1.9 in.) thick. Round iron rings with a diameter of 22 mm. ($\frac{7}{8}$ in.) are used at a distance of 200 mm. (7.8 in.) from each other.

Fig. 2 shows the general plan of the power house as it will be when all the projected extensions are made. The figure also shows the part already built. At the present time there are in operation two turbo-generator sets with a temporary transformer house and one boiler house. An extension of the building to contain two more turbo-generator sets, another boiler plant and a house for transformers, distributing boards and high-tension apparatus are under construction.

The coal used in the Kashira power station is Moscow low-grade brown coal containing 30 per cent water, 21 per cent ash and up to 4 per cent sulphur—i.e., about 55 per cent of useless elements, which sometimes rises to 60 per cent. Such a fuel necessitates careful attention to the mechanical features of stoking, and for this purpose the builders compiled data as to the speed of the grates, the air pressure and the thickness and form of the fuel layer.

The boiler house is 56 m. long and 42 m. wide (183 ft. x 141 ft.). The plan and cross-section are shown in Fig. 2. The walls of the building are of brick with the bunkers, columns, etc., of reinforced concrete. At the present time there are installed three Garbé boilers with a heating surface of 450 sq.m. (4,815 sq.ft.) each, two B. & W. boilers with horizontal tubes and a heating surface of 302 sq.m. (3,230 sq.ft.), and two Sterling boilers with a heating surface of 515 sq.m. (5,510 sq.ft.) each, making a total heating surface of 3,434 sq.m. (36,740 sq.ft.). Each of the boilers is fitted with economizers, the three Garbé boilers having Green economizers, all the others having Kabletz economizers. The total surface of the Green economizers is

740 sq.m. (7,910 sq.ft.) and that of the Kabletz economizers is 3,234 sq.m. (34,600 sq.ft.).

In the boiler room adjoining the turbine room are the feed-water heaters and four pumps, two electric pumps and two turbo pumps, with an output of 135 cu.m. and 120 cu.m. (4,765 cu.ft. and 4,236 cu.ft.) respectively. Wherever necessary water meters are installed. For the supply of air to the grates three electric motor-driven blowers (45 hp. each) are installed, each supplying about 500 cu.m. (17,650 cu.ft.) per hour. The ashes are taken out by means of wagons, each having a capacity of 10 cu.m. (353 cu.ft.) of hard ashes.

In the turbine room are installed two three-phase, 3,000-volt, 50-cycle Brown-Boveri turbo-generators, rated at 6,000 kw. each and separately excited. Railroad tracks are laid directly into the turbine room. The high-tension lines before leaving the transformer station pass through the oil switches and other apparatus. A transformer house will be built later. The building will correspond to the Koszuchow substation, described below.

This Koszuchow substation is situated in the south of Moscow close to the station of the Moscow-Okrouszny railroad. The substation transforms the voltage received from Kashira into the city voltage (6,600) and into that of the high-voltage ring which is to surround the town, following the lines of the Okrouszny railroad. The plan is the separation of the high-tension energy received and the high-tension energy transformed, while the control of all the switches will be on a special switchboard.

It is not proposed to install synchronous condensers in the station. It is intended to receive the necessary

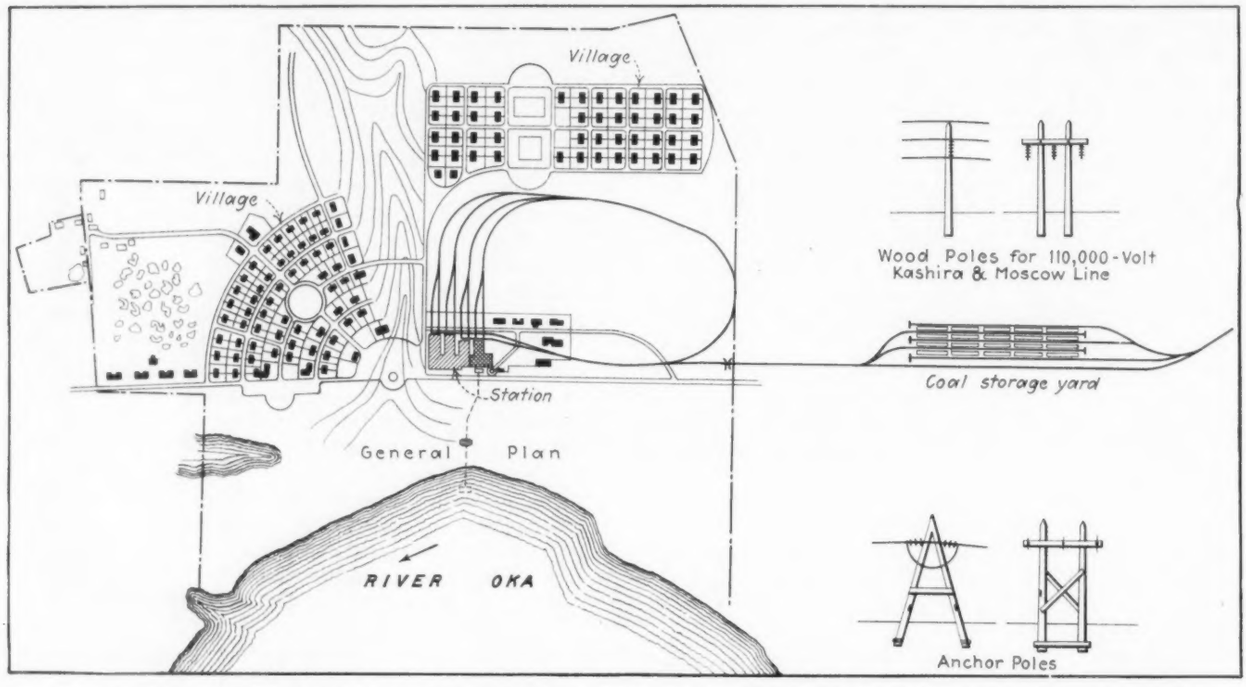


FIG. 1—THE KASHIRA STATION IS DESIGNED TO BURN LOW-GRADE COAL. ON RIGHT, DETAILS OF THE 110,000-VOLT LINE FROM THE STATION TO MOSCOW ARE SHOWN

plan and cross-section are shown in Fig. 2. For its own needs the power station has two 750-kva., 3,000/210-volt transformers and one reserve motor-generator set for excitation purposes. Close by is the distributing board to supply the station with its power and light.

On the second floor is the main distributing board, which controls the station generators and the outgoing lines. The diagram of electrical connections for the station as it is to be and for the part completed is shown in Fig. 2.

Under the switchboard are 3,000-volt oil switches and connecting switches. Close by is a temporary accommodation for single-phase, 4,000-kva., delta-star-connected step-up transformers with 3,000/115,000 volts between phases. All these transformers are of the shell type, copper losses being 48 kva., iron losses 38 kva., impedance drop 7.8 per cent. They have oil circulation, water-cooled.

All the oil switches are calculated to trip out 40,000 kva., under short circuit, the whole output of the station. This is calculated by taking into consideration the reactance of generators, transformers and leads. wattless current at first from the station of the former company "1886" (a Moscow electric power-station company) and in the future from the Symonovs station, for which special generators of corresponding apparent capacity will be used.

The transmission line which carries the power of the Kashira station to Moscow is noteworthy because it is the first 110,000-volt transmission line built in Russia and because it has been constructed entirely by Russian engineers of Russian material, with the exception of the high-tension insulators, and under the most trying conditions. The line starts at Kashira and terminates at the substation at Koszuchow. Another high-tension line will be built from Kashira and two high-tension lines from Shatourka to Moscow. From the Koszuchow substation underground cables carry the energy to the Moscow lines.

Copper-conductor stranded cable is used with a cross-section of 70 sq.mm. (0.11 sq.in.) and a diameter of 11 mm. (0.4 in.). Instead of iron supports wooden poles 11 m. (36 ft.) high, with a top diameter of 22 cm. (8.8 in.) are used. Cables are laid in the hori-

zontal plane 3 m. (9.8 ft.) apart. The lowest point of sag is 6 m. (19.6 ft.) instead of 7 m. (22.9 ft.) as prescribed by standard rules. To protect the line an overhead steel wire is used, grounded at intervals of 1,000 m. (3,280 ft.).

The calculations for this line have shown that without any apparatus for improving power factor and with a terminal voltage of 105,000 it is possible to transmit 10,000 kw. at 80 per cent power factor on the transformer secondaries and the corresponding station voltage will not be higher than 115,000. In transmitting

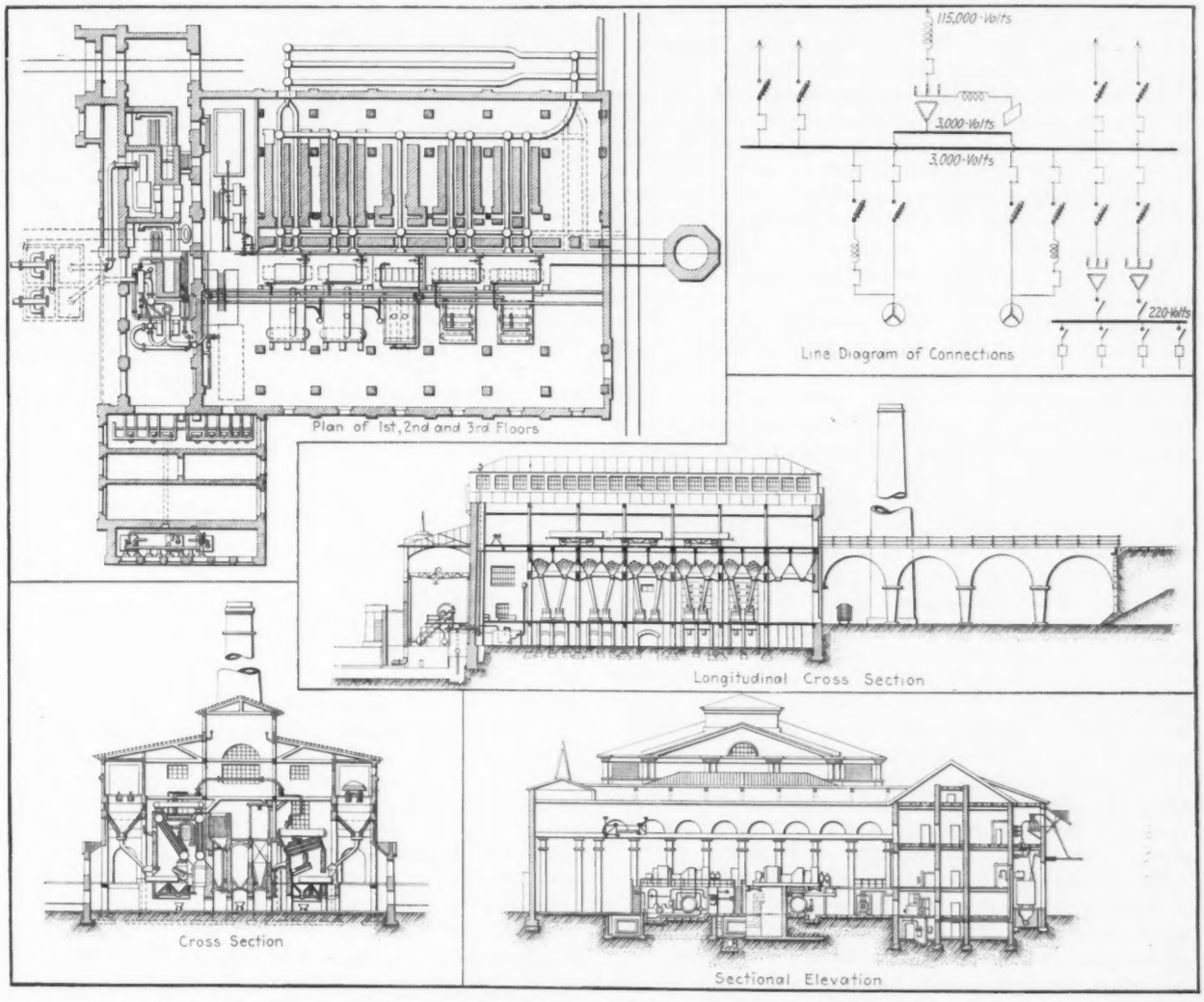


FIG. 2—THE KASHIRA STATION FOLLOWS AMERICAN PRACTICE IN DESIGN DETAILS AND CONTAINS A GREAT AMOUNT OF AMERICAN EQUIPMENT, ALTHOUGH THE 50-CYCLE TURBINES WERE MADE BY BROWN-BOVERI

15,000 kw. at a terminal voltage of 105,000 the station voltage will be above the limit (120,000 volts, the limit being 115,000). In transmitting 5,000 kw. with the same line voltage of 105,000 the station voltage will be about 110,000. With no load on the line the pressure at the central station will be about 104,000 volts.

The transmission line follows the highway at a short distance from it. To insure rapid receipt of material and better future control, six stores have been established at intervals to carry small line apparatus, conductors and other material. The transmission line is kept at a distance from dwellings and villages, which necessitated constructing angles averaging not more than 15 deg. but sometimes as large as 30 deg. The line crosses three railways, three rivers and one lake.

The distance between the supports is 100 m. (328 ft.). The standard support is two 11-m. (36-ft.) poles connected on the top by means of iron pins 19 mm. ($\frac{3}{4}$ in.) in diameter. The steel cable is attached on the top of the pole by iron clips. No measures to prolong the life of the poles were taken through lack of proper impregnating materials. The average weight of the standard support is about 60 kg. (132 lb.).

At every 1,000 m. (3,280 ft.) an anchor support has been erected calculated to support the line even should all three cables break. The anchor support is made of four standard poles held together by keys and pins. An adjustable wooden bracket is used at the height of the angle formed by the poles and is so arranged that it cannot move sideways. To take up the side stresses due to wind pressure diagonal struts are used, and to get a greater resistance in the ground the poles are connected to a wooden base. All connections except those in the ground are made by means of iron pins.

To insure a proper distance between the cable and the steel guy on the anchor, shaped iron cross-arms are used. As already stated, the anchor support will hold with all the three cables broken, taking into consid-

eration that no relief is given the wire through movement of the insulator strings, as is the case on the intermediate poles. The safety factor both of the anchor and the intermediate poles is equal to two and a half. The weight that the poles can sustain is 200 kg. (440 lb.) and the average weight of the anchor support is about 90 kg. (198 lb.). Special tests of the anchor supports were made before their erection. The load was increased to three times that which would be caused by the breaking of all the conductors, and the support stood the test.

Calculation has shown that the standard anchor support could be used at angles of not more than 3 deg. At big angles up to 30 deg. the anchor support is reinforced by struts. The distance between cables is increased at the angles. As large angles make the support rather bulky, angles of 30 deg. were taken as the limit. However, at one point an angle of 90 deg. had to be used. This was accomplished by using two sets of poles of different heights with struts, the conductors being laid one over the other and connected by means of vertical cables.

The transmission line crosses the River Oka by the bridge of the Ryazan-Ural railroad. The necessity of crossing the river at a high elevation because of the high water level in the spring and the difficulty of getting iron supports compelled the builders to attach cables to the bridge structure. On both sides of the river stone piers are used as the foundation of supports for the cables, which are carried on the bridge in a vertical plane, one under the other, by means of special iron arms. The length of these arms is such that the minimum distance of the cables from the iron frame of the bridge when there is a deviation between the bridge and the insulator string of 22.5 deg. would be 1.35 m. (4.4 ft.). The arms were fitted to the bridge by special attachments without drilling the structure itself. Over the whole length of the bridge the cable pull was decreased for safety reasons, and no steel pipes were used for grounding—the iron bridge serving the purpose. Leaving the bridge, the cables return again to the horizontal position.

The position of the cables in one horizontal plane has a bad effect on their mutual induction and capacity. To overcome this the cables are transposed at two points, dividing the line into three equal parts.

The insulators used on the line are of the suspension string type on intermediate supports and the suspension strain type on anchor and angular supports. At first an attempt was made to manufacture the high-tension insulators in Russia, but as this would have caused delay and the need for haste was urgent they were bought abroad.

It should be stated, in conclusion, that wooden supports were used only because the present position of Russian industry makes it very difficult to procure steel supports. It is recognized that wooden supports require replacement on an average once every seven years, and that this will interfere with the operation of the line. For this reason steel supports will be used later on. They are only a little more expensive than wooden ones.

For the information and data in this article I am indebted to material sent me by Engineer B. W. Lassoff, to a report made by Engineer M. K. Polivanoff to the eighth all-Russian electrical convention, and to information kindly supplied by Prof. G. Krizizhanovsky, chairman of the government Commission for the Electrification of Russia.

Proper Ratio of Tooth Width to Slot Width

Theoretical Treatment Brings the Conclusion that the Best Results from Standpoint of Economy Come When the Two Are Equal

BY F. S. DELLENBAUGH, JR.
Research Division, Department of Electrical Engineering, Massachusetts Institute of Technology

OUTSIDE of efficiencies, the economics of electrical design—that is, maximum output for minimum material, labor, etc.—has usually been left to manufacturing experience and empirical rules. This is often necessary since the effects upon labor cost of various parts of the design cannot readily be included in theoretical formulas. But certain parts of it can be attacked from the point of view of optimum use of materials, and the following is presented as a method of attack which it is believed can be extended to other parts. The results indicate that the minimum amount of core material will be necessary when the slot width is equal to the tooth width. It is true that this result is usually approximated in practice, but is arrived at from entirely different considerations, and these results are therefore in confirmation of existing practice from a new point of view, rather than an extension of design possibilities.

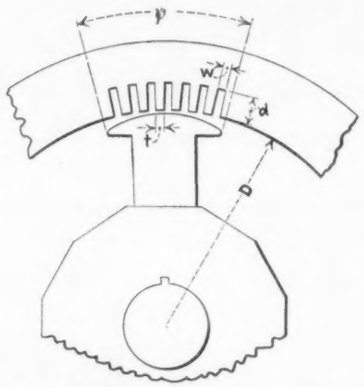


FIG. 1—ARRANGEMENT AND SYMBOLS USED IN REVOLVING-FIELD MACHINE

It is assumed that the design deals with dynamo-electric machinery and has progressed to the point where the first approximations have been made of the armature diameter and the coil and slot size. The division of electric and magnetic loading must then be made. A large number of slots and low flux or the reverse may be chosen. It is obvious that if the number of slots be large enough, a point will be reached where the minimum tooth width will be zero and the flux density in the teeth thus infinite. If, on the other hand, the number of slots be decreased to zero, the flux must be infinite and therefore the density in the teeth will again become infinite. It would thus appear that somewhere between the two extremes the flux density in the teeth would be minimum, and conversely, the minimum amount of core material would be required to carry the flux at the desired density. This point of minimum tooth density, or optimum ratio of slot to tooth width, can easily be arrived at as follows:

Let:

ϕ = flux per pole.
B = tooth density.
E = generated emf.
C = number of circuits in armature winding.
N = revolutions per minute.
p = number of poles.
n = number of slots.

A = area of teeth per pole carrying flux.
γ = turns per coil in armature winding.
ν = coils per slot in armature winding.
d = slot depth.
w = slot width.
ψ = polar embrasure, or arc expressed in percentage.
L = armature core length, net iron.
D = armature (air gap) diameter.
t = tooth width.

If all dimensions are in inches, B is in lines per square inch. If all dimensions are in centimeters, B is in gausses, or lines per square centimeter. Flux fringing is neglected, and it is assumed that the tooth density B is that at the point of minimum tooth width and is the average value assuming that $\psi n/p$ teeth per pole are the only ones carrying flux.

The minimum tooth area for the revolving-field type of machines will be at the tip and is equal to the total internal periphery of the armature core less the amount cut away by the slots, assuming a straight side slot and open top. Thus:

$$A = (\pi D - wn)(L\psi/p) \qquad (1)$$

If the machine is of the revolving-armature type, as is common practice with direct-current machinery, then the diameter at the bottom of the teeth must be substituted for D, but otherwise the formula will hold. If the slots are not straight with parallel sides, then special diameters must be substituted, but with this restriction the results may be considered perfectly general.

Then

$$B = \phi/A = \phi p/(\pi D - wn)(L\psi). \qquad (2)$$

The formula for generated voltage may be expressed:

$$E = 2\phi pNn\gamma\nu/(C \times 60 \times 10^8)$$

Or:

$$n = EC \times 60 \times 10^8/(2\phi pN\gamma\nu) \qquad (3)$$

Substituting (3) in (2) and simplifying:

$$B = (2\varphi^2 p^2 N\gamma\nu)/(2\pi D\phi pN\gamma\nu - wEC \times 60 \times 10^8)L\psi \qquad (4)$$

In this last equation B and ϕ are the only variables for a given set of dimensions, and so it may be written:

$$B = \phi^2/(K_a\phi - K_b), \qquad (5)$$

where $K_a = \pi DL\psi/p$

and $K_b = 30wECL\psi 10^8/(p^2 N\gamma\nu)$.

In order to determine the minimum value of B the first derivative is equated to zero, which gives:

$$dB/d\phi = (d/d\phi)\left[\frac{K_a\phi - K_b}{\phi^2}\right] = 0,$$

whence $\phi_o = 2K_b/K_a$ (6)

and $B_o = 4K_b/K_a^2$, (7)

ϕ_o and B_o being the values for minimum density. Substituting the actual values of the constants we get:

$$\phi_o = (60wEC \times 10^8)/(pN\gamma\nu\pi D). \qquad (8)$$

$$B_o = (120wEC \times 10^8)/(N\gamma\nu\pi^2 D^2 L\psi). \qquad (9)$$

It is interesting to note that the proper value of flux according to this reasoning is independent of the core length, depending entirely upon the punching design, while the actual density may be varied by changing the core length in the usual way. Fig. 2 shows how the actual values of flux and tooth density vary in a commercial design if the number of slots be changed, other dimensions being maintained the same. The point at which the machine actually operated, having been designed from other criteria, is very near that of minimum core weight. Other machines have been found which do not check so closely. Any point between the two vertical lines would be considered satisfactory from the standpoint of ratio of magnetic to electric loading. In general, the less the flux, the cheaper the machine and the poorer its electric characteristics. If the flux is reduced below the minimum tooth-density point, these densities are seen to rise very rapidly, but for fluxes too high the effect upon tooth density is not so marked.

Data from another actual machine give the following:

$E = 120$,	$\gamma = 1$,
$C = 8$,	$\nu = 2$,
$N = 200$,	$w = 0.4$ in.
$p = 8$,	$\psi = 0.712$,
$*D = 36.9$ in.,	$L = 10$ in.

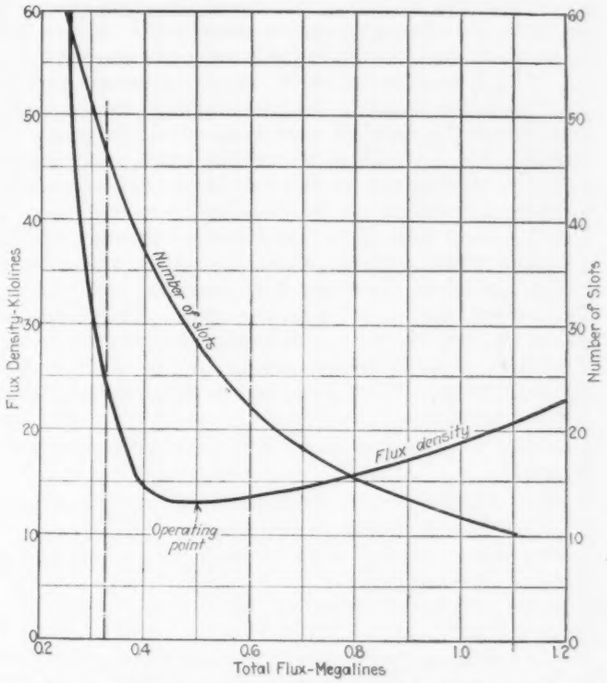


FIG. 2—VARIATION OF MAXIMUM FLUX DENSITY IN THE TEETH WITH THE TOTAL FLUX PER POLE AND NUMBER OF SLOTS CHANGED

These data were taken from actual design and the operating point is shown as used. As concerns questions of electrical and mechanical loading any point between the two vertical dot-dash lines would theoretically be satisfactory.

Substituting in (9), (8) and (3) respectively, we get:

B_o = 120,000 lines per square inch.
$\phi_o = 6.2 \times 10^{-8}$ lines per pole.
n = 145 slots.

From which the tooth width at root should be:

$$(\pi 36.9 - 145 \times 0.4)/145 = 0.4 \text{ in.}$$

Or, the width of tooth and slot should be equal.

That this is always the case may be shown as follows:

$$t = (\pi D - nw)/n.$$

If the value of D be determined from (8) and substituted with the values of n in the numerator from (3), this expression will reduce to:

$$t/w = 1.$$

Therefore this ratio will hold regardless of other dimensions. There are, of course, many approximations included in the argument, but it gives another guide in design, which is always useful, and so far as the writer is aware is the first time this ratio has been determined solely from considerations of the amount of material required.

*This being an engine-type direct-current generator, the diameter is taken at the inside, or roots of the teeth.

Obsolescence in Distribution Transformers

Method for Its Determination—Economics of Transformer Replacement—Specific Analysis of Transformer Characteristics and the Application to a Distribution System

BY R. E. CURTIS
Distribution Engineer Luzerne Gas & Electric Company, Kingston, Pa.

IT IS a generally recognized fact that it pays to replace old transformers having a high core loss with modern designs, but when the engineer has to show the manager exactly how many dollars will be saved by making a certain investment the amount is not always easy to calculate. It is necessary to have the nameplate data on the transformers and also the manufacturer's data on core loss, which may have to be corrected for aging of the old cores. In making a study of this nature for the Harvey's Lake Light Company, a utility under the management of A. J. Sordoni, the writer found the following method helpful:

Transformers should be replaced when the interest on the additional investment is less than the value of the kilowatt-hour core loss per year. The following expression represents the difference between these two quantities, and the annual saving (S) in dollars which can be expected. When this value is negative the change is not warranted.

$S = 8.76r(w_2 - w_1) - i(A - B)/100$ dollars per year.

Where

r = value of one kilowatt-hour as delivered from the distribution primary in dollars.
w_2 = core loss in watts of the new transformer to be erected.
w_1 = core loss in watts of the old transformer to be removed.
i = annual interest on additional investment in per cent.
A = cost of new transformer in dollars.
B = cost of old transformer in dollars.

DISCUSSION OF THE TERMS

The cost of energy (r) per kilowatt-hour delivered to the transformer should include a proportion of all operating costs up to this point, including generation, transmission, substation and distribution (primary). Those utilities purchasing energy wholesale and distributing should add to the wholesale cost price an amount to cover the maintenance of the substation and the distribution primary.

The core losses (w_2, w_1) of the various makes of transformers at the date of manufacture may be obtained from the maker and should be corrected for operation today, allowing for aging of the iron. All core losses should be referred to normal voltage rating (2,300 to 230-115 volts) at 75 deg. C., in accordance with A. I. E. E. standards.

To facilitate using the above formula we tabulated the differences in core loss ($w_2 - w_1$) as shown in the table herewith. In this particular case all of the equipment was of General Electric Company manufacture, so the accompanying table applies only to General Electric transformers. Any engineer may make up a similar table to apply to his own equipment by obtaining the necessary data from the manufacturers. In this connection note that for General Electric transformers the form letter must be known, and correspondingly for Westinghouse transformers the style number.

The annual interest (i) on the investment is generally fixed by commission rulings. Where a depreciation fund or renewal and replacement reserve is being built up the value i must be large enough to cover this item in addition to the interest on the investment in the transformers.

The cost of the new transformer (A) should include freight, handling, testing and storeroom charges. It should not include the labor of erection unless this labor is allowed in capital accounts.

The cost of the obsolete transformer (B) is its value appearing on the books of the company and should include freight, handling, testing and storeroom charges.

DIFFERENCE IN CORE LOSS IN WATTS BETWEEN OLD AND PRESENT DESIGNS
(General Electric Company type H distribution transformers, 60 cycles, single-phase)
All figures based on operation at 2,300/230-115 volts at 75 deg. C.

Kva. Rating		Difference in Core Loss (w_2-w_1)		
New Transformer, Forms K & N	Old Transformer, Forms E, F, I, C, A, G & H	Forms E,F, I, C, A*	Form G	Form H
1½	0.6	14	7	3
1½	1	25	13	10
1½	1½	33	20	16
1½	2	45	28	22
3	2	36	19	13
3	2½	39	23	17
3	3	43	24	23
3	4	63	37	32
5	4	55	29	24
5	5	60	45	32
7½	7½	94	53	46
10	10	112	73	59
15	15	144	97	69
25	25	180	104	77
25	30	222	143	102
37½	30	180	101	60
37½	40	250	152	123
50	40	208	110	81
50	50	296	160	133

* Forms E, F, I, C and A have 25 per cent added to core loss at date of manufacture to allow for aging of the iron.

The labor cost of erection should be omitted unless it is already included in capital accounts and is allowed by the commission.

The salvage value of the old transformer should not be deducted in arriving at this cost. The only increase in total capitalization by making any change is the difference between A and B. The difference between cost B and the salvage value of the old transformer is indicative of the depreciation of this transformer and should be made up out of the depreciation fund. If no fund is in reserve for depreciation, it may be inferred that past earnings have been diverted from this fund to dividends. This additional capital, however, cannot be added to the capital account, as it does not represent any tangible property.

SPECIFIC EXAMPLE OF APPLICATION

The following examples will illustrate the application of this method and formula:

A. A utility purchases energy wholesale at $0.02 per kilowatt-hour. It is estimated that $0.001 per kilowatt-hour will provide maintenance charges on the conversion equipment (substation) and $0.004 per kilowatt-hour will provide maintenance charges on the distribution poles and primary lines. What annual saving will occur if a 10-kw. General Electric form E transformer costing $92.14 is replaced with a modern General Electric transformer of the same size costing $106.80 including freight and handling? Interest may be figured at 10 per cent, allowing 7 per cent

for interest on the investment and 3 per cent for depreciation.

Solution:

$$S = 8.76r(w_2 - w_1) - [i/100(A - B)].$$
$$r = \$0.02 + 0.001 + 0.004 = \$0.025.$$
$w_2 - w_1 = 112$ watts (from table).
$i = 7 + 3 = 10.$
$A = \$106.80.$
$B = \$92.14.$
$S = 8.76 \times 0.025 \times 112 - 0.1 \times (106.80 - 92.14)$
$= 24.53 - 1.47$
$= \$23.06$ per year.

B. Assume the conditions of problem 1, except that a recent inventory of this company's property recognized the obsolete condition of this transformer, and its book value appears as $22, which is practically equivalent to its salvage value.

$r = \$0.025.$
$w_2 - w_1 = 112.$
$i = 10.$
$A = \$106.80.$
$B = \$22.00.$
$S = 8.76 \times 0.025 \times 112 - 0.1 \times (106.80 - 22.00).$
$= 24.53 - 8.48$
$= \$16.05$ per year.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

A Difficulty in Distribution

To the Editors of the Electrical World:

I am a small manufacturer of an electrical device which has a growing use in the central-station industry, and as the *Electrical World* has opened its pages to the discussion of distribution problems in a frank and constructive fashion, I look upon this as an opportunity to point out a real need as I see it. My product has been on the market for several years; it is well standardized on the basis of thorough engineering design and careful selection of materials, is carefully made and renders excellent service when intelligently handled. It is used by technically or semi-technically trained men and is certainly in a small way one of the staple devices of the trade. How can I get the best distribution of this product?

Writing as frankly as I do, it is unnecessary to identify our commodity, for the problems which I encounter in its distribution are also those of other small manufacturers. For some time I have been trying to sell this device more widely through the electrical supply jobber and have had connections with several large houses of wide reputation and extensive resources. Those connections continue, but for some time our organization has been handicapped by the lack of intensive service on the part of the jobber-agent. We find it to be the case that many customers who purchase direct from us make their payments much more quickly than do the large jobbing houses. The latter do not show the interest in our product, which is increasing in diversity and popularity, that we believe should qualify an "honest-to-goodness" sales policy.

Our resources are modest, and we cannot afford an extensive staff of traveling salesmen to represent our factory direct in different parts of the country. We have spent some years and many hard-earned dollars in developing our line to a point where it is, without overstatement, the standard of its kind in its particular field. Naturally we would expect to secure the best results in distribution through a high-grade jobbing representation, but our product sells for say a few hundred dollars or so, and in any one city the market once sold is not very open for additional equipment. Yet we are expanding our line, as I said, and our experience in the central-station field emboldens us to branch out in the number and variety of our products, so that we shall soon be making on a larger scale devices that have more than an academic application to the distribution systems of utilities.

The difficulty seems to be that the jobber is so busy selling material in bulk that he has little time to undertake the engineering salesmanship which would push our line. I may exaggerate the situation, and yet we need more active representation. Our jobber friends are "sure pay" in due course, but it does prove inconvenient to have them lag behind some of our other customers. It may be said, "Why does this manufacturer sell direct at all?" I think it is in a way up to the jobber to answer this question, for if he can show by his commercial service and interest that we would do better to route all sales through him, our minds are open on the subject. Perhaps we should abandon jobber representation in view of the fact that there is comparatively little need of the jobber's carrying a stock of our best-known product; but, considering the selling abilities of the modern jobbing organization of high grade and the expansion of our own line into broader fields, that does not seem to be the answer.

We can accomplish a good deal, no doubt, through intelligent technical press advertising; but here in the electrical industry are great mechanisms of distribution that should function more efficiently in broadcasting the products of small manufacturers no less than of larger ones. It may be that the answer is through the so-called "manufacturer's agent" who maintains offices in this city or that and covers a wide territory with little stock requirements. I am frank to say that the present situation is unsatisfactory, and I shall be much interested if some suggestions as to its improvement can be presented in these columns for the benefit of the small manufacturer. Every little helps, and I believe that through closer co-operation by distributors men of manufacturing size can play the game more effectively and to the mutual advantage of the branches of the industry concerned. A SMALL MANUFACTURER.

Boston, Mass.

Professor Jackson Hopeful About Engineering Schools and Training

To the Editors of the Electrical World:

At the present time much discussion of engineering education and its relation to the industries is being carried on. Witness, for instance, the appointment of the committee on engineering education by the National Industrial Conference Board, the activities of various universities in co-operative courses and similar movements. There is also great activity in the engineering schools themselves in the way of studying curricula and methods of teaching, for the purpose of making sure that the practices are the best adapted for laying the foundation for fine, competent engineering.

The line of discussion that N. A. Carle suggests in the *Electrical World* for Nov. 4 is one that might be well worth while taking up, but I am not so pessimistic as he is regarding the degree of learning in the profession which is now characteristic of engineering schools. DUGALD C. JACKSON.

Massachusetts Institute of Technology,
Cambridge, Mass.

Industrial and Station Practice

Installation, Operation, Test and Repair of
Generating and Distribution Equipment and Methods of
Economically Utilizing Electrical Energy

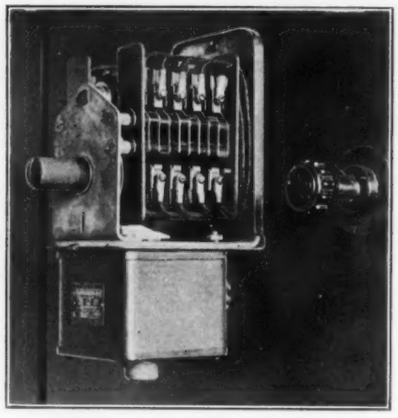
Multi-Contact Auxiliary Relay Provides Differential Protection

THE protection of electrical equipment against internal short circuits and grounds by relays actuated from current transformers differentially connected around the equipment is rapidly gaining favor, particularly when used with the larger classes of apparatus such as generators, transformers and motors on important duty. In the case of generator protection the tripping of the relays by differential action is required to perform a number of separate operations in proper sequence, such as opening the main oil circuit breakers, the field circuit breaker and the circuit breaker in the neutral ground connection, closing the main steam throttle valve and the generator air-dampers, and also sounding an alarm. It is, of course, very important that the relays perform their functions with a high degree of reliability and with a minimum chance of failure.

Relays heretofore available for performing these functions have not seemed to be sufficiently rugged and reliable, considering the importance of the service they were to provide. Several instances are in mind where such relay equipment has failed to function satisfactorily because of imperfect alignment or oxidation of contacts, with the result that the tripping circuits have not been energized.

In an attempt to remedy this condition, an auxiliary multi-contact relay was designed in co-operation with engineers of the General Electric Company. This is a relay which must be used in conjunction with other relays of the instantaneous or time-limit type connected in the differential current-transformer secondaries. The tripping of these relays actuates the auxiliary relay.

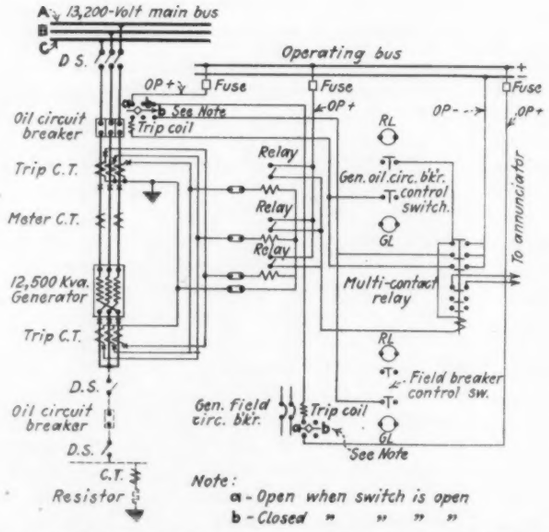
This relay is of very sturdy construction and can be equipped with contacts to close a maximum of nine separate circuits and to open one circuit. Any set of contacts, however, may be easily changed from the circuit-closing type to the circuit-opening type or vice versa. When the number of contacts required is not greater than five, only the lower contact-shaft element of the relay is furnished, but with necessary brackets for supporting the additional parts for the upper contacts if it is desired to insert them at some later time. The contacts are hand-reset by means of a handle projecting from the front of the case. A mark is provided on this handle to indicate the position of the movable contact members.



ADEQUATE PROTECTION TO APPARATUS AFFORDED BY THIS RELAY

The relay in operation trips a latch allowing the contact shaft or shafts to rotate to an angle of 90 deg. by means of a substantial spring torsion. The latch is sufficiently secure to prevent faulty action due to vibration or jar such as might be experienced on a switchboard panel and is tripped by a comparatively heavy blow. Both moving and fixed contacts are much heavier than those ordinarily used in switchboard relay construction, and a decided rubbing action is provided which insures proper contact at all times. The contacts are all mounted within an inclosed cover to keep them free from dust and foreign materials.

A representative wiring diagram



RUGGED AND RELIABLE RELAY FOR DIFFERENTIAL PROTECTION OF AN ALTERNATING-CURRENT GENERATOR OR TRANSFORMER

of this relay used for differential protection of an alternating-current generator is shown in one of the accompanying illustrations. Only wiring for tripping the main oil circuit breaker and the field circuit breaker and for operating an annunciator is indicated. It is evident that additional tripping circuits may be used as desired. Proper sequence of operations is usually obtained by auxiliary switches on the affected equipment.

Relays of this type were recently installed for generator and transformer protection at the Clinton Street station of the Queens Borough Gas & Electric Company, Far Rockaway, Long Island, New York, and have been ordered for installation in the South Meadow station of the Hartford (Conn.) Electric Light Company and for the Cannon Street Station of the New Bedford (Mass.) Gas & Edison Light Company. The photograph reproduced herewith shows an installation of one of these relays at the Clinton Street station of the Queens Borough Gas & Electric Company.

C. A. CORNEY.
Stone & Webster, Inc.,
Boston, Mass.

Operating Cost of 10,500-Kw. Central Station

OPERATING costs of the generating station of the Stamford (Conn.) Gas & Electric Company, as filed with the Connecticut Public Utilities Commission for the year 1921, illustrate afresh the importance of fuel economy in plant administration. The station is situated on Long Island Sound, and the present generating equipment includes six 600-hp. water-tube boilers, one 7,812-kva. and two 3,125-kva. turbogenerators. During the year the company burned 16,195 tons of coal in this plant, the average cost per ton being $8.20. The total output generated was 17,134,600 kw.-hr., and the operating costs were: Station wages, $41,367; fuel, $132,698; supplies and miscellaneous expenses, $6,326, and station repairs, $34,072, making a total of $214,465, or 1.25 cents per kilowatt-hour.

The fuel cost per kilowatt-hour was 0.775 cent and the labor cost 0.242 cent. The coal consumption per kilowatt-hour was 2.11 lb. The connected power load of the company is 13,219 hp. and the population served is 44,241.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Definite Transmission-Line Standards Recommended

SPECIFIC recommendations on transmission-line standards have been compiled by the sub-committee on transmission lines of the Empire State Gas and Electric Association. These recommendations cover insulation, wire spacing, clearance from line wire to ground, clearance for telephone wires and insulation for telephone wires.

Operating companies are frequently called on to construct new transmission lines, and it is not uncommon that the new lines come at some voltage different from the voltage at which they have been accustomed to operate. Every time a new line of any importance is to be constructed some one must decide all of the essential engineering details regarding the line. Unless the superintendent or engineer is thoroughly satisfied that he is acquainted with the best practice as regards transmission-line construction, he very often spends a large amount of time looking up data on other lines which have been constructed or recommendations in the various publications. If the search is extensive, it is found that there is such a wide variation in construction details of different companies that the construction man is still very much at sea as to the best details to follow in his particular line.

TABLE I—TRANSMISSION-LINE INSULATION

Line Voltage	Suspension-Type Number of Insulators (10-in. Disk) Suspension	Strain	Pin-Type Rating All-Wood Construction	Grounded Steel Pins
13,200	2	2	27,000	35,000
22,000	3	3	35,000	45,000
33,000	3	4	45,000	55,000
44,000	4	5	55,000	*66,000
66,000	5	7	*75,000	*88,000
110,000	8	10	.....	.....

* Pin-type insulator not recommended for important lines operating at 66,000 volts and above.

TABLE II—WIRE SPACING ON TRANSMISSION LINES WITH BARE COPPER WIRE

Line Voltage	Pin-Type Insulators Maximum Span, Feet 150 to 250 Ft.	600 Ft.	Line Voltage	Suspension-Type Insulators Maximum Span, Feet 250 Ft. Vertical Arrangement	Horizontal Arrangement	600 Ft. Vertical Arrangement	Horizontal Arrangement
13,200	3	4½	66,000	6	7	8	9
22,000	4	5	110,000	9	10	10	12
33,000	4½	5½					
44,000	5	6					
*66,000	6	6					

* Pin-type insulators not recommended for important lines operating at 66,000 volts.

In order to make it unnecessary for construction men to be required to follow this procedure in the future, the accompanying tables have been prepared, covering most of the essential information on transmission lines of the ordinary operating voltages. The recommendations as given in these tables cover what is considered to be high grade construction in every particular. A careful review will show that the insulators specified, the wire spacings, etc., are somewhat larger than many companies have been in the habit of using. However, some companies that have had a wide experience in transmission-line work use even higher standards than those set up in the tables.

The effects of climate, as regards lightning, sleet, wind, rainy and dry seasons, have a very large influence on the type of construction to be used. Since climatic conditions have such a large influence on the type of construction required, the recommendations given should be considered as applying to New York State and other localities having somewhat similar climatic conditions.

TABLE III—CLEARANCE FROM LINE TO GROUND AT SUPPORTS

Line Voltage	Suspension-Type Insulators: Clearance to Nearest Part of Structure—Insulators Vertical to 15 Deg. Deflection (Inches)	Minimum Clearance Insulator Deflected 45 Deg. (Inches)
13,200	11	9
22,000	16	14
33,000	16	14
44,000	22	19
66,000	26	22
110,000	42	36

In some cases the construction man may be justified in adopting a somewhat lower standard than has been recommended. This applies to Tables I, II, III, IV, V, and VI. Table V, which gives clearance from conductor to ground, is quite conservative, as the clearance given is in excess of that required by the National Electrical Safety Code for all voltages. One of the committee members recommends, however, that the minimum clearance be set at 25 ft. for all voltages.

The headings of Table III were somewhat hard to word clearly. "Clearance to nearest part of structure, vertical to 15 deg. deflection," is intended to mean the clearance from the conductor, when supported by suspension insulators, to the next cross-arm below or to any of the steel members of the tower when the insulating string is hanging in a

TABLE IV—MAXIMUM PERMISSIBLE SPAN LENGTHS FOR HARD-DRAWN AND MEDIUM-HARD-DRAWN BARE COPPER WIRE OF SMALLER SIZES

Wire Size	Span Length, Feet
No. 6	150
No. 4	300
No. 2	500

vertical position or in any position from vertical to 15 deg. deflection either side of vertical. These distances were taken somewhat greater than the distances in the next column, for the reason that by far the largest part of the time the insulator string is in a vertical or nearly vertical position.

The next column of the table is "Minimum clearance, insulator deflected 45 deg." These figures represent the minimum allowable distance from the conductor to the nearest grounded metal point on the tower when the insulator string is swung

TABLE V—MINIMUM CLEARANCE TO GROUND AT LOWEST POINT IN SPAN OVER COUNTRY OR ALONG ROADS, BUT NOT OVER ROADS OR RAILROADS—AT 60 DEG. F AND NO WIND

Voltage	Clearance to Ground, Feet
Up to 50,000	23
Over 50,000	25

over to a position 45 deg. from the vertical. It was the intention to make the striking values with the insulator string in this position somewhat greater than the over-all wet striking distance over the insulator string.

After these tables were prepared, they were checked against the National Electrical Safety Code and compared with the specifications of a number of operating transmission lines. It is believed that they do not violate any of the rules of the Safety Code, and in our opinion they rank among the best of the various specifications that have been tabulated in the past.

In preparing these tables the committee has gone, perhaps, somewhat farther than any such recommendations have been carried in the past. This was thought over very carefully as regards the question of establishing precedents, and it was decided that the value of the tables as prepared would more than compensate for any criticism which might arise from going beyond previous work that had been accomplished along this line.

The recommendations are not in any sense original, and there is nothing new in the recommendations except that we have never before seen a set-up so complete as this for transmission-line and telephone-line construction. These remarks perhaps apply more particularly to Table VI, giving the data on telephone lines. Recommendations on telephone-line standards have not previously been published as far as we are aware. Consequently this particular end of line construction has perhaps been a source of more trouble on the part of the operating man than almost any portion of the transmission line.

E. P. PECK.

Chairman sub-committee on transmission lines, Empire State Gas and Electric Association.

General superintendent electrical department, Utica Gas & Electric Company, Utica, N. Y.

TABLE VI—CLEARANCE FOR TELEPHONE LINE*

Voltage	To Ground, Feet	To Conductors, Feet
13,200	16	4½
22,000	16	5
33,000	16	5½
44,000	16	6
66,000	16	8

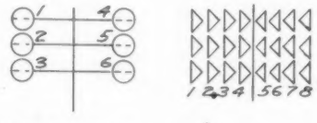
*Insulate telephone line for one-third line voltage when wooden arms and pins are used for telephone insulators, and insulate for one-half line voltage when grounded metal supports are used for telephone insulators. The large factor of safety provided in the transmission-line insulation is not contemplated in this recommendation. For this recommendation the insulators may be taken at the manufacturers' rating. For example, a telephone line under a 66,000-volt power line when on steel construction would be insulated with an insulator rated by the manufacturers at 35 000 volts, whereas the five suspension insulators recommended for the 66,000-volt line have been considered proper by some engineers for 110,000 volts. Transpositions are recommended every 500 ft. to 600 ft. in telephone lines. Insulating transformers and lightning arresters are essential and drainage coils are recommended.

Insulator Service Records

These Records Are Usually So Meager as to Afford No Basis for Purchases—Specifications for Orders Should Require Date to Be Imprinted in Porcelain

IT IS a fact hard to understand that so many central-station properties operating high-tension transmission lines keep such incomplete and unsatisfactory records of insulator service. The insulators are admittedly the most vulnerable of all the items entering into the make-up of a high-tension transmission system, yet how many companies having perhaps 50 miles or more of high-tension lines really know to what extent their various makes and types of insulators have given satisfactory service? In very many cases the extent of the operating superintendent's knowledge is that he has had lots of trouble on a section of line with certain insulators, and he has reached the conclusion that he wants no more of

OFFICE RECORDS. REPLACEMENTS ON SUSPENSION INSULATOR STRUCTURE.



File West
Structure No. 200
Line West 44000 V

Structure Built June 1915
Type of Construction Std. Dwg. T-3
Original Insulators OB Similar to 12464
Cross-Arm Iron

REPLACEMENTS						
Date	Position	Taken Down	Reason	Age	Put Up	Field Sheet
10-12	3-8	OB12464	Piece Broken off	3½yr	OB12464	A-18
6-21	5-1	OB12464	Leaking	6yr	OB12464	A-920
8-22	5-8	OB12464	Low Megger Cracked	7yr	OB825620	B-50

PROPER RECORDS MAKE IT POSSIBLE TO STUDY INSULATOR SITUATION

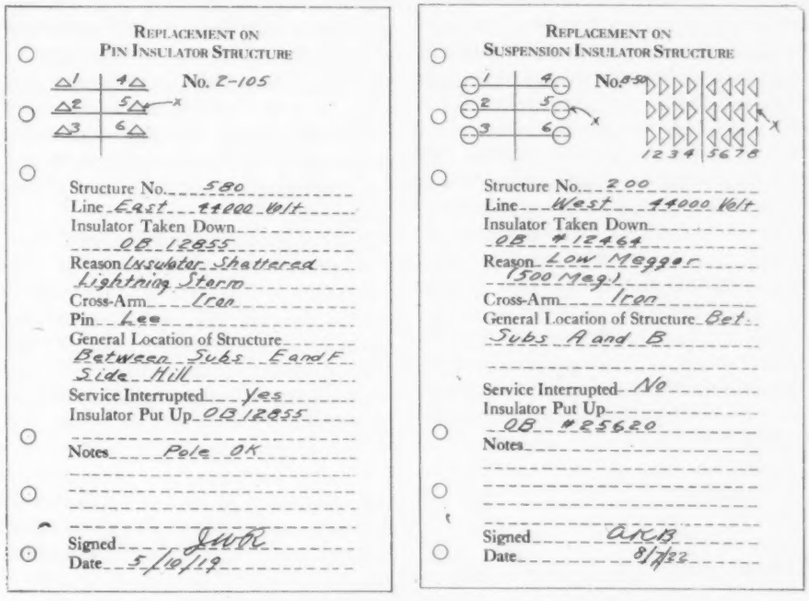
that manufacturer's insulators. On the other hand, he believes such and such an insulator is a good one; only about so many failed last year. Ask him, how many up? About so many. When were they put up? Oh, some in such and such a year, some more a little later, and lately he has been using them almost entirely for replacements.

Regarding replacements—does he know anything about the life in service of the ones taken down? No, because no one in the company knows just when they were put up. Does he know what caused the failures—whether most of them failed in the spring, or during lightning storms, or whether they were taken down because of small pieces broken off? No; he knows that some exploded during lightning, and probably hunters shot a few—but that's all. In many cases he isn't even keeping any record of the location of the different replacements which are being made at intervals. When he came to the company there were no insulator records, and the probabilities are that when he leaves there will be none either.

In the meantime the system has grown. Effort is made to run the generating end as efficiently as possible. If a generator or large transformer goes up, its history is pretty well known, and they try to "hang" the blame on the manufacturer. About all they do for the transmission line, though, is to go out and put up a new insulator every time one fails. And when it comes to purchasing additional insulator units the superintendent is very much at the mercy of the plausible insulator salesman. The salesman tells about the large orders he is getting from some companies and mentions the low rate of failure another company has (which figure in itself means nothing), and about all the superintendent can say is "Yes."

To go into the average small, and perhaps medium-sized, property and find how little its managers know about their insulators, one would think that there is something difficult in setting up and keeping these service records, or that perhaps they are of no value to the average operating superintendent. As a matter of fact there is very little trouble indeed in keeping the records, and they substitute a definite set-up of facts for a lot of guessing.

A very simple system is that in which a card is opened up for each structure the first time an insulator failure takes place. This card carries a diagram, and on this is noted as much information concerning the insulators on the structure as is available—the manufacturer and type of each, date put up, previous replacements, probable cause of previous failure. When an insulator is changed the foreman or lineman in charge notes on a similar diagram in a loose-leaf notebook all information as above outlined regarding



SIMILAR REPLACEMENT RECORDS SHOULD BE KEPT BY EVERY COMPANY FOR EVERY INSULATOR ON ITS LINES

both the insulator taken down and the one put up. The data are turned in to the superintendent and transferred to the cards. Line extensions are taken care of by making a general note on a card to the effect that all of the insulators on structures No. . . to No. . . were put in service on a certain date. Records such as this make it possible really to study the insulator situation. It is possible to say definitely whether one certain type is standing up better than another on this particular system—whether the best service is had from a heavier or lighter type, two-piece or three-piece, etc. Based on these records of past experience, the superintendent has a pretty good idea when and where to expect trouble in the future.

One of the explanations for the continued neglect of adequate records undoubtedly lies in the fact that so many of the present-day superintendents find themselves confronted with an existing system of which no records have ever been kept. They are inclined to use the neglect of the past as an excuse to carry on in the same careless way. Of course, as a matter of fact, the longer it is put off the longer it will be before a really valuable system of records is built up. It is always possible at any time to start keeping a record of replacements and new construction.

Unfortunately, insulators in themselves have no individuality—carry no nameplate—cannot be distinguished one from another. Once an insulator is put up and in service it looses its identity—unless records are kept. The age of an insulator cannot be determined by inspection. It is the difficulty of establishing this point of age that makes it hard to get so many properties started keeping an insulator record.

Because the element of life and service of line insulators is such a variable and unreliable one the writer believes that something should be done to enable identifying or classifying them by inspection. We have various methods of test to determine the insulating value of a piece, and as a general rule we can determine by inspection the manufacturer and style number. It would be of great advantage to be able to determine the approximate age or length of time in service also by inspection. This could be done very simply by imprinting in the porcelain the year of manufacture, this being done at the same time the manufacturer's name or mark is stamped on.

If the year of firing were to be shown on each insulator, it would be of much value as a means of checking the records and in helping out

those operators who, in spite of the manifest importance and advantage of these records, are not sufficiently alive and progressive to keep them. It is true that the time elapsed since firing and the age in service are not exactly the same, but these two periods are sufficiently close together for most purposes. There would be objection on the part of the manufacturers to adopting this date imprint as standard because of its prejudicial effect on stock insulators. However, there should be no difficulty in supplying this imprint in the case of large orders, because such orders are filled from the manufacturing floor and not from stock. It is believed that it would be a step forward if large purchasers would start to require this imprint in their specifications. One of the larger manufacturers has asserted that this date imprint would be very easy to supply and has expressed a willingness to comply with a purchase specification requiring it. If large purchasers start to require it, the time may come when it will be standard for all high-tension insulators. M. J. IDAIL,

F. R. Weller, Consulting Engineer, Washington, D. C. Electrical Engineer.

Design of Lighting Units Affects Maintenance

IF CLEANING be given proper consideration during the design of the luminaire, the cost of maintenance can be reduced to a minimum, according to the committee of the Illuminating Engineering Society's committee appointed under the chairmanship of M. Luckiesh to co-operate with fixture manufacturers. The luminaire when new and first installed should deliver and direct light in the quantity and direction for which it was designed. To assure sustained performance over a period of time the luminaire should be designed with maintenance in mind.

Losses due to the dust with the open bowl may be analyzed as follows: (1) Light leaving the filament suffers loss upon passing through the dust layer on the bulb. (2) A considerable part of the light leaving the bulb strikes the bowl, which is dust covered; in passing through this layer to the bowl there is a loss. (3) That part which has gone through the dust layer is reflected back and passes again through this same layer with resultant loss. (4) Some of the light reflected from the interior of the bowl passes through the dust-covered lamp bulb before leaving the luminaire, and further losses follow both on entering the bulb and on leaving it.

In comparison with these losses take the same bowl, inclosed with a clear-glass top so as not appreciably to alter the distribution of light. With this condition the light from the source that passes through the bulb to the bowl is reflected to the glass top with no appreciable loss due to dust. In passing through the clear-glass top there is a single loss due to dust collection on the outside surface of this cover. In both cases there is a loss of the same order of magnitude due to the dust collection on the outside of the bottom of the bowl when transmitting media are used.

When the luminaire itself has openings in it, such as holes in the bottom or in the holder, or a combination of both, the heated air in the luminaire rises rapidly through the holes at the top with an inrush of dust-laden cooler air through the bottom openings. This results in a coating of dust over the interior of the luminaire and lamp bulb. Consequently, if a luminaire is purposely designed to surround the light source so as to reduce losses from dust accumulation, a considerable part of its effectiveness is destroyed when openings of this kind are added.

Aside from these losses due to dust collection, deterioration of surfaces, such as the tarnish of silver, the yellowing of some white paints and so on, may result in further losses. In fact a gradual deterioration takes place with some material which ultimately results in the loss of the greater part of the light controlled by the luminaire. For the media most commonly used in luminaires the accompanying table shows the permanency, ease of cleaning and other factors that enter into depreciation.

MAINTENANCE FACTORS OF COMMONLY USED LUMINAIRE MEDIA

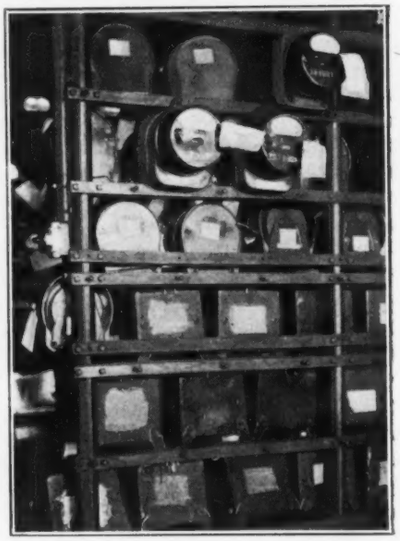
Matezial	Deterioration*	Restoration	Ease of Cleaning
Crystal glass	None	Excellent	Excellent
Etched glass	None	Good	Fair
Opal glass	None	Excellent	Excellent
Enamel glass (fired)	None	Excellent	Excellent
Silvered glass	Very slight	Excellent	Excellent
Prism glass	None	Excellent	Fair
Rippled glass	None	Excellent	Fair
Paper	Gradual	Poor	Poor
Parchment	Gradual	Fair	Fair
Mica (art)	None	Excellent	Excellent
Textiles	Gradual	Fair	Poor
Porcelain enamel	None	Excellent	Excellent
Painted surface (matt)	Gradual	Fair	Fair
Painted surface (glossy)	Gradual	Good	Good
Polished silver	Rapid	Fair	Fair
Polished aluminum	Gradual	Fair	Fair
Plaster	Gradual	Good	Fair
Enamel glass (unfired)	Gradual	Good	Excellent

* Normal interior atmospheric conditions are assumed. Of course, all materials will suffer deterioration under extreme conditions.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Racking 1,100 Meters in 720-Cu.Ft. Space

BY MEANS of a pipe frame and bar rack erected in two sections, each 10 ft. long and 12 ft. high, with a total width over rack ends of 6 ft., the United Illuminating Company, New Haven, Conn., stores 1,100 meters in limited quarters devoted to testing and other meter work. A section of the rack is illustrated herewith. It is composed of 1¼-in.



EACH METER AVERAGES A RACK SPACE OF 1,130 CU.IN

vertical iron pipes to which are clamped 1-in.x¼-in. iron bars fitted at intervals with 1¼-in.x $\frac{10}{24}$-in. bolts upon which the meters are hung. Between each vertical pipe a space of 2 ft. is allowed, and the friction obtained by clamping the bars to these uprights holds the bars and meters in place without the need of drilling holes in the verticals. This gives an excellent means of adjusting the spacing between horizontal bars to meet the requirements of different types of meters. The rack consists of sections providing four planes of meter suspension, 270 meters per section being easily cared for and there is sufficient space between the front and rear rack sections to permit easy access by meter department employees.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Danger in Municipal Ownership

Agitation Strikes at Foundations of Our Established Government, City Managers Are Told by a Former Member of the Public Service Commission of Indiana

AN INDICTMENT of agitation for municipal ownership as a menace which threatens to destroy the whole fabric of our national government was made by Paul P. Haynes of Indianapolis, formerly a member of the Public Service Commission of Indiana, in a speech before the national convention of city managers at Kansas City, Mo., on Nov. 9. In view of his former office and the nature of the convention which he addressed, Mr. Haynes' statements are of particular interest to central station men.

"The advocate of municipal ownership proceeds on the fallacious theory that because the state finds it necessary to regulate a business, it immediately follows that the city should own it," said Mr. Haynes. Pointing out that in several states grain elevators, warehouses, motor buses and other kinds of private business have been declared public utilities and subject to regulation, Mr. Haynes asserted that the next step may be regulation of the prices of coal, steel, ice and food products and other necessities and public ownership of such enterprises.

"Where will the advocates of municipal ownership halt?" asked Mr. Haynes. "Will they in their zealous pursuit of a vain idealistic fancy blindly strike at the foundations of our established government? Do they propose to carry their ill-premised argument to the inescapable demand that the cities and other governmental units should own and operate all industries and businesses which now or hereafter may be declared public utilities?

"If the municipal ownership advocate is right about electric, gas, street railway and other utilities, he must, in such a situation, demand the public ownership and operation of these additional enterprises. I cannot believe that the municipal ownership advocate would stand for such a revolutionary development in American life, and if he does not profess or stand for such a revolutionary development, he is fundamentally wrong in advocating the public ownership of those enterprises which have so far been declared to be public utilities.

"The path which the municipal ownership advocate is blazing leads inevitably to government ownership of all public necessities and to the destruction of the whole fabric of our national government. The trouble is that he does not know where he is going. He has ignored the broader aspects of the question and does not realize that, unwittingly, he may be lighting the torch which, fanned by an aroused spirit of unrest and discontent, may start the fatal conflagration which in our land the torchbearers of more revolutionary purposes has so far failed to kindle."

Rural Service Impossible

Extension of electric light and power and other utility service to small communities and to the farms would be blocked by the spread of municipal ownership in cities, Mr. Haynes said. "There is a very practical and decisive objection to municipal ownership under any form of city government," he continued. "Several classes of public utilities, in order to serve the public more adequately and at lower rates, have rapidly developed beyond municipal boundaries. Take, for example, electric utilities. The day of the isolated plant is past. The modern development which is giving the public better service at lower rates is toward the construction of superpower plants at points where fuel and transportation are cheaper and where there is an abundance of water for condensation purposes, or on streams where hydro-electric power may be generated. These superpower plants in many cases are in the open country, entirely away from cities. High-voltage transmission lines carry the electrical energy to many cities, towns and villages.

"It will be only a few years until the entire country will be webbed with interconnecting high-power transmission lines. The isolated plant will be no more and the small generating station will disappear. Maximum economies and efficiencies will be developed, service will be better and rates lower. New industries will spring up and old ones will be able to expand, and out of it all the public will be the greatest beneficiary. Municipal ownership of electric plants would make this notable achievement impossible.

"The telephone is another striking example of the impracticability of municipal ownership, and what I have said about the electric industry applies measurably to street railways, gas companies and other utilities."

Mr. Haynes declared that municipal ownership is destined to failure because of the political aspect of city government.

"It is the political foundation underlying all city governments which will always prevent successful public ownership and operation of utilities," said Mr. Haynes. "Public utilities require the constant application of sound business judgment, expert operation, skilled management, and above all continuity of wise business policies. No city primarily governed by popular rule possesses, or can be certain that it will long possess, these qualifications so essential to the utility business. No city the policies of which are determined by popular vote can long continue to apply sound economic principles and business methods to its ownership and operation of utility properties, for the simple reason that cities are essentially political agencies—not necessarily partisan, but, broadly speaking, political.

"The city manager can, and does I believe, administer the affairs of cities more efficiently and economically, but the best of super-managers

cannot change the inherent political character of city government, and therein lies the failure of municipal ownership.

"State regulation has corrected the chief abuses which the original advocates of municipal ownership believed to exist. The state is the logical unit to provide regulation of public utilities. Municipal ownership is nothing more or less than an exaggerated form of municipal regulation, for the city admittedly does not go into the utility business to make money. Few will argue that we should now abandon state regulation and go back to local control. What America needs is less politics in business."

An Advantageously Situated Central-Station Office

CENTRAL-STATION companies are coming to realize the advantages of locating their offices and salesrooms in the shopping center of a city, and the new Gas and Electric Building just completed by the New York & Queens Electric Light & Power Company in Flushing, Long Island, is a fine example of this practice.

The building occupies a vantage point in the heart of Flushing's business section within a block of every bank in Flushing, it is just across the street from the post office and is only one block from the main railroad station.

The building was designed primarily to afford suitable facilities for offering customers an adequate merchandising service, and the accompanying illustrations show the appearance of the building and how the sales floor has been laid out.

Increase of Capital Stock Preferred to Bond Issue

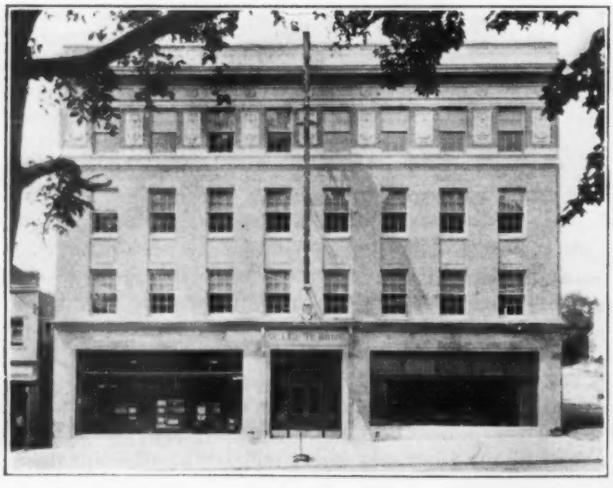
POINTING out that his company can finance new construction at the present time more advantageously through issuance of stock rather than bonds, President Charles L. Edgar of the Edison Electric Illuminating Company of Boston discussed various financial problems bearing upon the expansion of New England's largest central station at a recent hearing before the Massachusetts Department of Public Utilities. The hearing was in connection with the proposed issue of $5,406,700 additional capital stock, which is in the proportion of one share for every five shares of the existing stock, and the directors voted to offer the new stock at $150. Mr. Edgar's presentation followed an inquiry by Commissioner Stone as to the feasibility of a bond issue in place of the proposed stock offering.

Before the war, Mr. Edgar said, the Boston Edison company had virtually no bonds, and as a result the company had ample credit from 1915 to 1921. Had the property been heavily bonded, this would not have been the case. When the work now under way on the Edison system is completed the company will have $80,000,000 in plant. In Mr. Edgar's opinion, a debt of $25,000,000 is enough to have on an eighty-million-dollar plant. The matter is largely a question of judgment. There is no intention of issuing coupon notes permanently. The witness felt that in the case of many corporations bonds have been issued in overproportion to their capitalization. The company's coupon notes amount to about $19,000,000. Practically no bonds are outstanding as compared with the total capitalization. At some future time, Mr. Edgar said, conditions may be ripe for a bond issue, but in the judgment of the management the present conditions are less favorable for a bond issue than for a stock issue. Mr. Edgar said that had the war not come on the company would undoubtedly have had a low-rate bond out by now.

Commissioner Stone intimated that the company would have saved in interest by issuing bonds. In reply Mr. Edgar said that the company could not have raised the necessary money in that way. In the last seven years it has expended $25,000,000 with nothing except its credit to go on and the issue of stock. The stockholders, he said, have never received more than 7 per cent, and the company would have had to pay more for money that it raised by bonds or notes during that time. The company paid 8 to 9 per cent for money during a part of the period.

Small Lots of Utility Stocks Appeal to Customers

LIMITATION of the number of shares of stock in special offers of utility securities to new holders has proved to be a considerable factor in promoting a wider distribution of shares among customers. F. L. Hall, secretary and treasurer of the Narragansett Electric Lighting Company, in describing the progress of customer ownership in Providence, R. I., points out that that company now has 8,000 stockholders and expects in time to have at least 25,000 investors in its



VIEWS OF GAS AND ELECTRIC BUILDING AND COMPANY'S SALESROOM IN FLUSHING, L. I.

securities. The present list of stockholders has been built up largely by selling from time to time comparatively small blocks of stock in a limited number of shares to each subscriber.

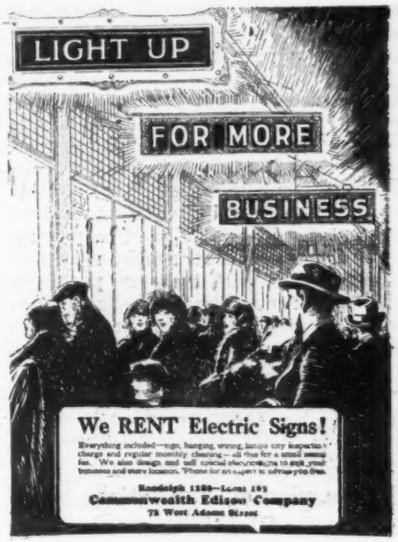
A few years ago the company's officials purchased 4,000 shares of stock in the open market for resale in small lots to new holders who paid just what the stock cost. Not over five shares were sold to any one individual. In 1920 8,400 shares were sold to new holders and 6,000 shares have been sold so far in 1922. "We shall need $1,500,000 in new money yearly for the next five years," said Mr. Hall, "and by broadening the market for our shares customer ownership will help raise this sum."

Commonwealth Edison Starts Sign Campaign

TO BUILD up its electric sign business in Chicago the Commonwealth Edison Company has adopted a plan of renting signs on a two-year contract basis. Under this arrangement the company furnishes, installs and wires standard 12-in. or 16-in. letter signs according to the customer's specifications and maintains the sign for a period of two years. The company takes out the city inspection permit and provides all the necessary wiring up to and including 80 ft. of conduit. If more conduit is required to complete the installation, the customer assumes this additional expense. New lamps are provided by the company without additional expense to the customer. The customer in turn agrees during the term of his contract not to remove, change nor hang additional panels on the sign without the consent of the company.

The various designs offered for rent include the "silveray," porcelain enameled steel, sectional lamp letter and panel types. The lamps in the panel signs number twenty-four or thirty-two with a choice of wattage of 10 or 25. The "silveray" signs are charged for according to the number of 12-in. or 16-in. panels. The rates charged for this service are shown in the accompanying table. Roof signs are also furnished by the company, and the customer is allowed five years in which to pay for them provided he owns the building or has a five-year lease.

The monthly rental charges are



NEWSPAPER ADVERTISING ASSISTS SALESMEN IN RENTING SIGNS

divided into two rates—one rate applying to the first twenty-four consecutive months and a lower rate becoming effective at the expiration of these twenty-four months. However, should a customer desire to pay the city inspection fee and do his own wiring, the company will furnish the sign and bill him monthly at the lower rate—on the same basis as though he had rented the sign for twenty-four months. These signs are wired to the house meter, and the energy consumed is charged for at the regular rates and classed as additional business.

This method of renting signs has been in operation since June, 1922. The city is divided into eight districts, which are covered by eight salesmen. To aid these salesmen in canvassing their districts the company has started a newspaper advertising campaign. It has been rather difficult to obtain sign salesmen who are capable of selling signs, as it is a highly specialized branch of the business and much educational work is necessary. It also requires a great deal of study on the part of a salesman where the customer is unable to give him all the details for a proper sign installation. However, the returns during the past four months show good results in the development of this business as a revenue producer for the company.

MONTHLY RENTAL AND MAINTENANCE CHARGES FOR ELECTRIC SIGNS

Type of Sign	Charge During First Twenty-four Consecutive Months' Use	Charge After First Twenty-four Consecutive Months' Use
Panel Signs:		
Containing thirty-two 10-watt or 25-watt "Mazda" lamps, per sign, per month	$12.00	$8.00
Containing twenty-four 10-watt or 25-watt "Mazda" lamps, per sign, per month	9.85	6.25
Sectional Signs:		
Containing 10-watt or 25-watt "Mazda" lamps, per socket in the sign, per month	0.19	0.14½
Silveray Signs:		
Containing 60-watt "Mazda" lamps, per 12-in. panel in the sign, per month	1.00	0.50
Containing 60-watt "Mazda" lamps, per 16-in. panel in the sign, per month	1.25	0.75

What Other Companies Are Doing

Chicago, Ill.—Service badges have been presented to 118 employees of the Commonwealth Edison Company who have been in the employ of the company more than five years. Nine men received badges for periods of service of twenty-five years or more. Among the three men who have completed thirty-five years of service was Vice-president John F. Gilchrist. Twelve of the forty-seven employees who received five-year badges were women. Miss Helen Norris, dean of the women employees, presented the women's badges, and Homer E. Niesz, manager of industrial relations, presented the men's badges. Vice-president Louis A. Ferguson addressed the gathering.

Dallas, Tex.—C. W. Davis, general manager of the Dallas Power & Light Company, in discussing the expenditure by his company of $2,180,000 during the next eighteen months in completing its new power station, stated that Dallas had doubled its demand for electric current since 1916 and that an increase of 200 per cent is anticipated by 1924. Dallas used 84,000,000 kw.-hr. last year, and the Dallas Power & Light Company expects a consumption of 88,000,000 kw.-hr. this year. The new station will have a rating of 15,000 kw.

Malden, Mass.—Gross appliance sales by the Malden Electric Company in September totaled $10,056, against $5,936 for September, 1921. Gross electric appliance sales for the first nine months of 1922 were $84,261, against $56,362 for the same period last year. A vigorous drive is being made for new business in this and other Tenney properties.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Hydro-Electric Station at L'Isle Jourdain, France.—J. REYVAL.—The latest plant added to a 20,000-hp., 60,000-volt tie-in transmission system in southern France is the L'Isle-Jourdain station, of which a short description is given in this article. The station may well serve as a modern model for medium-head hydro-electric exploitation. It utilizes a drop of 30 ft. Four vertical-shaft, 167-r.p.m., Francis turbines of an average output of 2,400 hp. each are installed, driving direct-coupled, 50-cycle, 5,000-volt, three-phase generators and a belt-coupled exciter. A transformer bank of four single-phase, 2,000-kva. water-cooled transformers raises the generator potential to the trunk-line voltage of 60,000.—*Revue Générale de l'Electricité,* Oct. 21, 1922.

Water-Power Possibilities in the Middle West.—C. W. PLACE.—Hydro-electric developments in different parts of the country have very different physical characteristics. The author shows some aspects of the service requirements peculiar to the Middle West and then discusses the form of hydro-electric development best suited to meet these conditions.—*General Electric Review,* October, 1922.

Commercial Economy of High Pressures and Temperatures.—In the opinion of one prominent consulting engineer, steam plants operating at a pressure of 1,200 lb. per sq. in. and a total temperature of 750 deg. F. are justified as coming commercial developments. Physical conditions and thermodynamic considerations favor increasing pressures. Higher temperatures are attainable but are not so conducive to economy. Other changes which may produce savings equal to those proposed in prime-mover conditions are referred to in the article. —*Power,* Oct. 31, 1922.

Generation, Control and Switching

The Operation of Frequency Changers.—L. M. SMITH.—The author considers the two principal uses of the frequency changer—namely, to supply a certain portion of a load at a different frequency from that of the main load and to interconnect two independent systems of different frequency each having its own generating plant. The first case is comparatively simple, the operation consisting of connecting one element of the frequency changer to the supply system and the other element to the subsidiary system. In the second case the operation is more complex, depending upon the type of apparatus used and the nature of the service for which it is installed. There are three methods where this changing from one frequency to another may be accomplished. The first is known as the induction type. This consists of a wound-rotor induction motor the stator windings of which are connected to the system whose frequency is to be changed, the rotor, which is separately driven, being connected to the subsidiary system. The second method is known as the induction-synchronous type, consisting of an induction motor of either squirrel-cage or wound-rotor construction driving a synchronous generator. The third, and most common, consists of two synchronous machines which will transfer power in either direction according to the load or to the speed regulation of the governors on the prime movers of the two generating systems. The various applications of these systems are illustrated by a number of examples.—*Association of Iron and Steel Electrical Engineers,* October, 1922.

Transmission, Substations and Distribution

Influence of the Shape of the Voltage Curve Upon Tests of Suspension-Type Insulators.—M. F. DAHL.—Based upon a number of actual tests, the author shows the great influence of the shape of the voltage curve upon the results of tests made on high-voltage disk-type insulators. The voltmeter, at a certain flash-over test, showed, for example, 138,000 volts, while the evaluation of the oscillogram taken at the same time indicated a crest voltage of 152,000. The author claims that it is safe to assume that the ideal value of $\sqrt{2}$ is never reached for testing voltages as there are too many factors involved which tend to distort the shape of the originally sinusoidal form. Factories of electric porcelain know, as a rule, the exact shape of the voltage curve of their testing machines; but it is recommended that its shape be checked against an oscillographic record for different connections and arrangements of the tested objects. Discrepancies of as high as 20 per cent from the assumed value may occur and may be the cause of an unjust rejection of insulators which have no real defect.—*Bulletin de l'Association Suisse des Electriciens,* October, 1922.

Relation of the Petersen System of Grounding Power Networks to Inductive Effects in Neighboring Communication Circuits.—H. M. TRUEBLOOD.—A simple theoretical treatment of those features of the Petersen method of grounding a power network which are of principal interest from the standpoint of inductive effects in neighboring communication circuits. In the first section of the paper the behavior of the power system at the time of faults with a grounded phase is discussed, with an explanation of the principal characteristic effects of the reactor. In the second section of the paper the behavior of the power system with reactor under normal operating conditions is discussed with reference to noise and other inductive effects in neighboring communication circuits.—*Bell System Technical Journal,* Vol. 1, No. 1.

Outdoor Substation Construction.—W. S. JONES.—The author does not go into the complete design or construction of outdoor transformer stations, but touches on the few points and details which, as a rule, do not receive timely consideration during the design and installation of such stations.—*Electric Journal,* November, 1922.

Units, Measurements and Instruments

Development of Meters Since the War in Germany.—K. SCHMIEDEL.—The paper gives a detailed review of many important mechanical and electrical developments in the design of electric meters. Practically all improvements concern alternating-current meters, for hardly any changes can be observed in the direct-current models. For three-phase lines with neutral conductor (four-wire systems) the preference is being given now to meters with three measuring systems, an arrangement which gives a simpler connection between the phases. The energy consumption in the potential circuit of older types of meters amounted to 1 watt to 1½ watts for a torque of 4 to 5 gram-cm. Latest types require only about 1 watt for the same torque. The accuracy of modern meters within the limits of 5 per cent and 100 per cent is always less than 1 per cent plus or minus. The power factor affects the integration very little. New forms of measuring systems of the three-legged iron-core type are now used by Siemens, Körting, Mix and Pipersberg, all showing a minimum of magnetic resistance. The A. E. G. and Meyer use a "form G" iron core, while Firchow meters have two separate cores. A radically different system is employed in the Aron meters, which contain a combination "G" and "E" form core, with all resulting poles in one plane. The new A. E. G and Siemens meters are described in detail as to their mechanical construction. The terminals are usually molded into a compound block. No porcelain parts are used today in meters. Cylinder-type counting devices with a horizontal axis are the general rule. The use of alloy-steel laminations for the cores of meters is still being disputed. Alloy steel is very hard on the punching dies, and by proper arrangement very small core losses may be achieved with ordinary "dynamo steel." The author regrets the lack of new developments in direct-current meters. The use of iron in the series circuit would be a great improvement, but it is at present impossible, as no steel can be obtained with sufficiently uniform properties.

Permanent magnets with a stronger field would also be of great value. Cobald-tungsten-steel, recommended recently by Honda and Saito, would be magnetically a success, but it is far too brittle.—*Zeitschrift des Vereines Deutscher Ingenieure*, Vol. 66, No. 13, 1922.

Illumination

Lighting Designs for Stores.—J. R. COLVILLE and C. E. WEITZ.—Lighting examples and recommendations for a number of store interiors, both large and small, together with suggestions and notes on the lighting of display windows are given in this booklet. Good engineering has produced lamps and standard equipment which diffuse and distribute the light, and has determined relations as to the mounting height and spacing which indicate the best location of units. Suggestions are included as to the amount of illumination which may be expected from certain sizes of lamps when used in typical reflecting equipment.—*Bulletin No. 45 of the Engineering Department, National Lamp Works of General Electric Company.*

Motors and Control

Electric Drive of Blooming Mill.—The Hadfield steel mill of Sheffield, England, has recently applied electric drive to one of its largest duo-blooming rolls. Two pairs of rolls arranged side by side in one line, both of 28½-in. diameter, are driven by a direct-current double motor of a normal output of 3,200 hp. with a peak capacity of 11,600 hp. Its speed can be regulated from zero to 60 r.p.m. The torque varies between 40 and 138 ton-meters. From full speed forward the motor can be stopped and accelerated to full reverse speed within three to four seconds. A motor-generator set with a 30-ton flywheel supplies the rolling motor. It consists of a 1,800-hp., 600-r.p.m. induction motor and two shunt-wound 650-volt, 1,300-kw. to 4,750-kw. direct-current generators. The energy demand of this set during the heaviest rolling stays within the limits of 1,800 hp. and 2,000 hp.—*Le Génie Civil*, Sept. 23, 1922.

Factors Affecting the Selection of Electric Motors for Steel-Mill Auxiliary Drives.—Part I.—L. A. UMANSKY.—It is essential in steel-mill work to make the motor fit the drive, and the author's analysis of the method of determining the correct motor to use should find a broad field of usefulness in the steel industry. Virtually all the mechanisms of the steel-mill auxiliary drives can be replaced for calculation purposes by simple elementary forms. The inertia force can be readily figured out, and the resultant load on the motor can then be calculated exactly in the same way as the load produced by any other force, such as gravity, friction, etc.—*General Electric Review*, October, 1922.

The Automatic-Start Polyphase Induction Motor.—JAMES L. HAMILTON.—The author covers the characteristics, electrical and mechanical designs of the automatic-start, polyphase induction motor. The article sets forth the general characteristics as compared with other standard types of motors, outlines a commercially practical method of studying the electrical design of existing motors and discusses the mechanical design. This motor consists of a field or stator of laminated toothed construction having the usual two-phase or three-phase winding. The armature or rotor has two windings, one being a progressively wound, low-resistance winding connected to a short-circuiting device and the other winding being of high resistance squirrel-cage design.—*Journal of the A. I. E. E.*, October, 1922.

Heat Applications and Material Handling

Electric Steel Furnace.—A GRÖNWALL and F. HORSCHITZ.—Comparing the advantages and disadvantages of the different types of known electric furnace systems, the authors foresee the possible victory of the combined arc and resistance type as developed by Girod, Nathusius and Grönwall. The article describes the latest types of these furnaces, which are being built in standard sizes from ½ ton to 12 tons and are suitable for melting steel, ferro-silicon, brass and other metals and alloys. Two-phase current permits the use of two electrodes with the third line connected to a bottom plate in the furnace. The latter is placed on the neutral of the system, so that it carries 1.417 times the current of the electrodes. For a three-phase supply system two single-phase transformers in T-connection are recommended. For a 10-ton furnace 950 kw. to 1,400 kw. is required, consuming 700 kw.-hr. per ton of steel, starting with a cold charge.—*Elektrotechnik und Maschinenbau*, Oct. 15, 1922.

Welding Tubes Into the Tube Sheets of Boilers.—F. H. WILLIAMS.—In determining the best method of welding the tubes into the tube sheet, the writer considers the effect of the welding on the metal of both the tube and the sheet, the effect of the final outline of the tube end, and the amount of work required to perform the entire operation from start to finish.—*Power*, Oct. 10, 1922.

Electrophysics, Electrochemistry and Batteries

Measurement of the Color Temperature of the More Efficient Artificial Light Sources by Rotatory Dispersion.—IRWIN G. PRIEST.—A new method of measuring color temperatures between 3,000 deg. and 4,000 deg. absolute centigrade is described and discussed, with data on the color temperature of the gas-filled tungsten lamp and the carbon arc. Light from a source of known spectral distribution is modified by passage through a quartz plate between nicol prisms, which constitute in effect a blue filter of adjustable spectral transmission. The spectral transmission is adjusted by rotating one of the nicols. The source and the thickness of quartz are so chosen that the energy emerging from the second nicol has the spectral distribution characteristic of a complete radiator. The light from the source whose color temperature is to be determined is color-matched by rotating one of the nicol prisms. The temperature is obtained from this rotation by a method described in the paper.—*Scientific Paper No. 443, Bureau of Standards.*

Traction

Magnetic Blow-Out as Applied to Railway Control.—L. G. RILEY.—The purpose of this article is to discuss the characteristics and fundamentals of effective blow-out design and to show how these principles have been utilized in the development of a line of pneumatic switches applicable to railway control. The persistence of an arc formed by the separation of contacts under a load depends upon the speed at which the contacts are separated, the maximum distance to which they are separated, the voltage, the current drawn, the inductive characteristics of the circuit, the kind of contact material used, the degree to which the arc is confined to a limited space, etc. The practical results secured with contacts of various materials, of both high and low resistance, have led to what is considered an almost universal standardization on pure copper contacts, closed and opened with a rolling motion which establishes the arc at the tip of the contact, preserving the final seat at the heel of the contact in good condition for current-carrying duty.—*Electric Journal*, October, 1922.

Telegraphy, Telephony, Radio and Signals

High-Power Vacuum Tube.—W. WILSON.—A vacuum tube is described that is capable of delivering 100 kw. of high-frequency energy. This tube is water-cooled, about 2 ft. in length and weighs 10 lb. Another tube of similar construction with a delivery of 10 kw. is also described. The method of sealing heavy copper wire through the glass in such a way that the best vacua can be maintained is discussed.—*Bell System Technical Journal*, Vol. 1, No. 1.

Radio-Frequency Amplifiers.—P. D. LOWELL.—There are three methods of coupling the output of one tube into the input of another tube so as to provide a multistage amplifier of radio frequencies. These are resistance coupling, tuned plate coupling and transformer coupling. The last named method is usually the most satisfactory and permits of amplification at almost any frequency. This paper deals for the most part with this method and gives circuits and constructional details for transformers with both air and iron cores. The iron-core transformer will usually operate satisfactorily over a much broader wave band than the air-core transformer, although the construction of a successful radio-frequency amplifier is quite a difficult task.—*Scientific Paper No. 449, Bureau of Standards.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

New York Water Power

Governor-Elect Smith Protests Against Any Grants to Companies by Outgoing Administration

AN UNUSUAL political situation closely connected with water-power development has arisen in New York State, where Alfred E. Smith, who received more than 400,000 majority for Governor in the recent elections, has, acting on a report in an up-state newspaper, sent the following dispatch to Attorney-General C. D. Newton, a member of the State Water Power Commission:

"Nov. 22, 1922.

"HON. CHARLES D. NEWTON,

"Attorney-General, Albany, N. Y.

"MY DEAR GENERAL: It has been called to my attention that the State Water Power Commission is to meet in Albany tomorrow morning at 10 o'clock. I have been further informed by a newspaper article that it is the intention of the commission to act upon some applications for licenses to develop electrical energy by private corporations. The paper that I read says that there is a possibility that a license may be granted to some company to develop energy from the waters of Niagara below the falls.

"Before and during the campaign I took a decided position with regard to the development of electrical energy from water power owned by the state. I have held that it should not be given to private companies for private development, but should, on the other hand, be developed by the state itself under state ownership and state control for the benefit of all the people of the state.

"I would therefore ask you, in view of the decision of the people at the polls following the campaign in which this subject was a distinct issue, not to grant any license or permits to private corporations for development of electrical energy from water-power resources that belong to the state, and permit that subject to be dealt with by the incoming administration in accordance with the explicit promises made during the course of the campaign.

"ALFRED E. SMITH."

"I understand," said the Governor-elect in explanation of his action, "that in the waters of the Niagara gorge there is 200,000 potential horsepower. All I am interested in is that this vast hoard of potential energy, which might be of untold benefit to the people of the state and is worth a king's ransom, shall not be given away to any private corporation for fifty years, as under the existing statute the Water Power Commission can do if it has a mind to.

Interviewed at Albany, Attorney-General Newton intimated that there was no disposition on the part of the Water Power Commission to hurry matters or do anything that would prove embarrassing to the new Governor.

THREE APPLICATIONS BEFORE COMMISSION

"Three applications are now before the commission for action," he said, "and they can be acted upon as soon as everything is in shape. However, I do not believe that we will do anything without consideration."

The three applications to develop power are from the Niagara Gorge Railroad, the Niagara, Lockport & Ontario Power Company and Thompson & Porter. These applications have been before the commission for months, and in August last the Water Power Commission went to Niagara Falls and looked over the proposed power sites.

The commission, which contains five members, of whom four are elective state officers, is now solidly Republican. After Jan. 1 the Democratic party, to which Governor-elect Smith belongs, will control it by three to two.

Radio Records Broken

Forty-five seconds from London, fifty-five from Norway, a little longer from France and two minutes and forty seconds from Germany—these were the periods of time taken to receive answers by radio to dispatches inquiring about the weather sent from the Engineering Societies Building, New York City, under the direction of David Sarnoff on Wednesday night. Mr. Sarnoff spoke before the New York Electrical Society, which was holding its regular monthly meeting, and predicted the coming of a "wrist-watch wireless set, or radiolet," by means of which "a man could receive in his vest pocket market reports, weather reports and details of championship games."

On the same day all amateur long-distance records were said to have been shattered at the radio station of Hiram P. Maxim, president of the American Radio Relay League, when a radiogram was sent to Wailuku, Hawaiian Islands, and the answer was received in four minutes and eighteen seconds. The radiogram was relayed at Sleepy Eye, Minn. The distance from Hartford to Sleepy Eye by air line is about 1,200 miles, and thence to Wailuku 4,000 miles.

Colorado River Treaty

Agreement Among the Seven States and the Federal Government Has Been Formulated

AGREEMENT on the main principles of a treaty to be entered into by the federal government and the seven states interested in the development of the Colorado River has been reached at the meeting of the Colorado River Commission, which assembled at Santa Fé, N. M., on Nov. 9 and has since been in session. Details are not, however, as yet available.

Secretary of Commerce Hoover is chairman of the commission, on which Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming have each one representative. The conference is the first instance in American history where several states are making use of their treaty-making powers to effect an equitable appropriation of the benefits to be derived from the use of waters of an interstate stream, prior to the development of conflict respecting established uses.

The treaty agreed upon is understood to divide the seven states into two groups, with California, Nevada and Arizona in the lower division and Utah, Wyoming, Colorado and New Mexico in the upper division, equal amounts of water being allotted to each division. Preference in right is given to the use of water on established irrigation developments and no existing rights are to be disturbed. Another commission, to meet after the lapse of several years, is recommended. No announcement was made regarding allocation of water to Mexican territory or whether water passing from the upper to the lower divisions is to be measured.

The governors of the seven states concerned have been asked to join the commission at Sante Fé to give their final views. After approval by the commission the treaty is to be submitted for ratification to the legislatures of the several states and to Congress.

Secretary Hoover stated that the matter of power had been taken entirely out of the hands of the commission by direction of the President and delegated to the Federal Power Commission. The flood-protection needs of the Imperial Valley were recognized as an extremely urgent reason for immediate erection of control works, which will probably be undertaken at Boulder Canyon by the national government when the treaty shall have been signed.

Last spring the commission held meetings at Phoenix, Ariz.; Salt Lake City, Denver and Los Angeles.

Electrical Supply Jobbers Have Record Attendance

Further impulse was given this week to the rapidly increasing interest which electrical men of all classes are showing in the problems of merchandising appliances at the annual winter convention of the Electrical Supply Jobbers' Association, held in Cleveland at the Hotel Cleveland. The entire program of the open sessions and a large part of the executive sessions were given over to the discussions of the problems of the retailer and the distributor for the purpose of focusing the attention of the industry more closely upon the vital contact with the ultimate consumer which it is the function of the local merchant to maintain.

John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, addressed the meeting Thursday morning on the subject "Merchandising Electrical Appliances" and dwelt at length on the need of greater knowledge of the cost of retailing electrical merchandise and the importance of developing a more satisfactory profit for electrical merchants.

W. R. Herstein, vice-president Electric Supply Company, Memphis, Tenn., spoke on "Electrical Merchandising Distribution" and discussed the responsibility of the jobber toward the retail trade and the opportunity for increasing the sale of appliances and accessories in the popular market by a more purposeful and effective co-operation.

W. E. Robertson, general manager Robertson-Cataract Electric Company, Buffalo, talked on "Business Promotion Activity," presenting interesting information on the work of the Joint Committee for Business Development and the successful results of the recent western New York State electrical conference held in Buffalo. He described the progress which is being made in league organization in that part of the state.

The convention opened on Monday, Nov. 20, with two days of executive committee meeting, and executive sessions of the full membership were held on Wednesday and Friday. More than five hundred were in attendance, a record number.

O. E. L. A. Business Promoters Discuss Merchandising

Insistence on better merchandising practice and higher-grade salesmanship in central-station commercial departments was the outstanding feature of an extremely well-attended meeting of the new-business co-operations committee of the Ohio Electric Light Association held at Dayton on Nov. 22. In a paper on "Central-Station Merchandising" J. E. Tills of the Commonwealth Edison Company, Chicago, emphasized the necessity of carrying selling activities directly to the customer's door and explained how this is done in Chicago through crews of salesmen operating from trucks. By this method alone that company expects to sell one million dollars' worth of electric appliances this year. J. E. North of Cleveland emphasized the fact that success in merchandising is dependent largely upon customers first being sold adequate wiring for their homes. Moreover, so-called new-business programs will almost invariably fail if not intelligently planned.

E. W. Hake, commercial manager of the Union Gas & Electric Company, Cincinnati, warned against employing salesmen of inferior quality to the detriment of the company's business and its standing in the community. He advocated most careful selection of men for such positions, which should offer sufficient remuneration to attract high-class salesmen, not peddlers.

J. Hall Truman, Jr., of New Philadelphia, Ohio, chairman of the new-business co-operations committee, in summing up the situation declared that if central-station companies are to become commercial institutions they must learn to be merchants, adopt logically planned sales programs and employ real salesmen trained by the companies to this field of endeavor.

The next meeting of this committee will be held at Columbus on Feb. 15, when commercial and home lighting will be discussed.

Ontario Hydro Accused of Deception

Gregory Commission, Appointed by Ontario Government, Estimates Loss at Nipigon at $750,000 a Year, Which Must Be Borne by the Province—History of the Venture

THE Hydro-Electric Inquiry Commission, locally known as the Gregory Commission, has issued an interim report covering its investigations into the Nipigon power project of the Hydro-Electric Power Commission of Ontario. It will be recalled that this commission was appointed by the Lieutenant-Governor in Council of the province to inquire into the report upon the Queenston-Chippawa power development and all other power developments undertaken by the Ontario commission and, generally, all matters of expenditure and administration by the commission.

The interim report just issued deals with the history of the Nipigon venture, the early stages of which, according to the report, were marked by some irregular procedure on the part of the commission. This development, it will be recalled, formed part of the investigation of the Hydro-Electric Power Commission of Ontario made by W. S. Murray and Henry Flood, Jr., for the National Electric Light Association. It is significant that the royal commission, composed entirely of Canadians, corroborates the general findings of the Murray and Flood report in that it also shows the Nipigon development to be unprofitable.

The present deficit, according to the Gregory Commission, is $340,000 a year and is likely to be nearer $750,000 annually before the tide turns. This burden, the commission suggests, cannot be carried by the Hydro-Electric Power Commission of Ontario, nor by the municipality of Port Arthur, for which the system was primarily promoted. The Province of Ontario, according to the report, borrowed the money for the work on behalf of the Hydro-Electric Power Commission of Ontario; the province signed the bonds, and willingly or unwillingly the province will have to make good the loss.

The Gregory report also suggests that the time has arrived for the provincial government to insist that the present standard contract adhered to by the Hydro-Electric Power Commission be not allowed to bar out responsible customers for power. The recommendation appears to apply to the case of the Great Lakes Pulp & Paper Company, which has refused on the advice of counsel to take 10,000 hp. from the commission, owing to details of the standard power contract.

Dealing with the history of the Nipigon development, the Gregory report points out that the Hydro-Electric Power Commission of Ontario omitted to publish an estimate of the maximum price at which power would be supplied and of the probable cost of the development. The reason for such omission, the report hazards, was the desire on the part of the commission to escape possible legal action should the figures ultimately exceed those given to the people when by-laws were submitted.

The original project, the report continues, was for a three-million-dollar development at Dog Lake. After the bylaws had been passed, however, the Hydro-Electric Power Commission of Ontario changed its plans and entered into a twelve-million-dollar enterprise at Cameron Falls on the Nipigon River. The power rights on the Nipigon were held by the Great Lakes company, and Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, was anxious, the report concludes, to secure those rights for the commission. He therefore negotiated a deal with the Great Lakes company which obligated the Ontario commission to supply it with power but failed to bind the company to take the power when it was available. This failure on the part of the company has been a severe blow to the Hydro-Electric Power Commission's revenue account. It is suggested by the Gregory Commission that the advances which the Province of Ontario must make to meet the annual losses at Nipigon be carried in a suspension account, with the hope that some day there may be a profitable market for the power, at which time these advances can be returned.

State Commissioners Hear Utility Officers

President Smith, Manager Aylesworth, Henry L. Doherty and Martin J. Insull Address Detroit Convention—New Classification of Accounts Adopted—Indeterminate Franchise Favored

AT THE final sessions of the annual convention of the National Association of Railway and Utilities Commissioners at Detroit last week, the first two days of whose proceedings were reported in last week's issue of the *Electrical World*, four representatives of public utility interests addressed the commissioners upon invitation. The commissioners also discussed and adopted new classifications of accounts for electric, gas and water utilities, passed a resolution urging more uniformity in regulatory laws in various states, and adopted another strong resolution urging the adoption of the principle of the indeterminate permit in the operation of public utility companies.

Responsibilities of Operators

In picturing the future immediately ahead of the electric light and power industry, Frank W. Smith, president of the National Electric Light Association, showed that the executives of a company as well as the public service commissions are charged with certain responsibilities. The officers and directors of the great public service corporation, he said, are no longer, if they ever were, a little group of men who own the enterprise and agree to run it in a narrow-minded, selfish way for their own profit. The utility has become a great human institution, a vital part of the life and welfare of thousands of men and women who are as much a part of the public as are any leaders of political activity.

While the public service commissions represent the public interests, Mr. Smith maintained that this responsibility was also shared by the board of directors of the present-day utility. These men are vested with responsibility to thousands of investors, on the one hand, and, on the other hand, to patrons and customers. The first tribunal, therefore, whose members sit dispassionately and try to keep a balance between these large elements of the public is the directorate of the utility. There the great mass of questions arising in public utility operation and management are decided soundly and fairly in the interests of all concerned.

According to Mr. Smith, if private ownership and operation of public utilities is to succeed and endure, public regulation must succeed and command a generous measure of public confidence. If public regulation is to endure, private ownership and operation of the utilities must ever be alert to conform its policies to the American spirit of fair play and the American desire for the best in public service. If private ownership departs from this course or if public regulation fails to achieve its intended purpose, our industries and our governmental institutions will be at the mercy of men whose views are alien to American traditions.

Plea for Sound Securities

M. H. Aylesworth, executive manager of the National Electric Light Association, showed the extent and advantages of customer ownership of utility securities.

Mr. Aylesworth defined true public ownership as that where a substantial percentage of people in the community served own a financial interest in the utility company, register their complaints and protest against imperfect service with their own managing employees, share in the earnings and have a direct voice in shaping the policies.

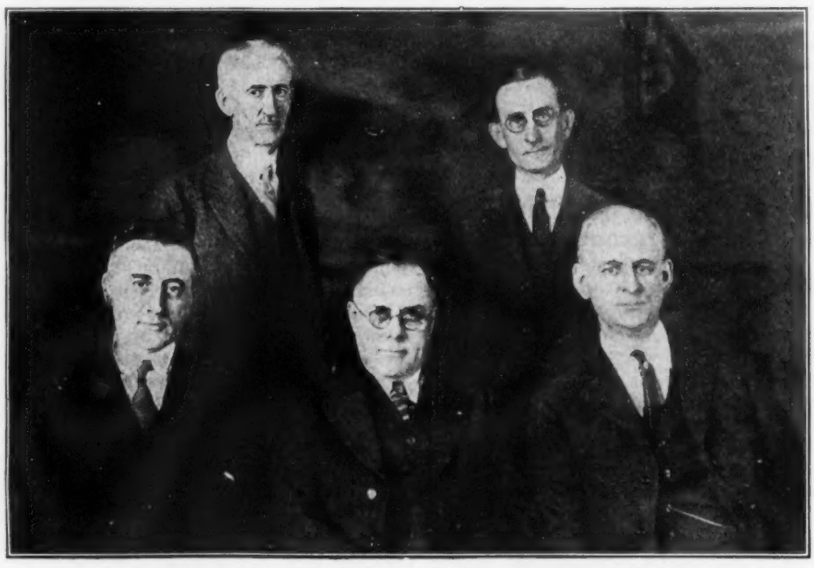
In view of the favorable public attitude toward utility securities and their widespread purchase by customers and employees, Mr. Aylesworth asked the commissioners to see to it that only stocks of unquestioned merit and stability, backed by good value and good management, be made available for customer-ownership campaigns. This, he maintained, is necessary in order to safeguard the priceless public support which electric public utilities now enjoy, and it is manifestly in the public interest.

Doherty on Regulation

Henry L. Doherty, head of Henry L. Doherty & Company, who was scheduled to speak, was detained by a court procedure in Virginia from actually attending, but he sent a personal representative who delivered his message to the convention. In this message Mr. Doherty declared that when the public takes the advice of the state utility commissions instead of expecting the commissions to follow its dictation, then and then only will the full benefit of intelligent regulation be realized. He said that the progressive and constructive public service companies want intelligent regulation and that they do not want to "fool with politics."

Mr. Doherty asserted that probably the utility operators themselves are to blame for the fact that "a large part of our citizens still think it is the duty of the state commissions to give the public services hell instead of justice." Reviewing the period of regulation without responsibility through which the public service companies have passed, he said that agitations for reductions in rates were formerly "a daily diet but an infrequent accomplishment," and that in the old days "a bill or ordinance would be passed which was generally intended by the agitators to be so drastic that it could not be accepted, an injunction would be issued, and then, after a long and expensive legal battle, the courts would be compelled to declare the rate confiscatory and the issue would still be alive as the basis for another political campaign.

Mr. Doherty called attention to the necessity for the adoption of a fair method of profit sharing, suggesting the adoption of a standard rate for utility service, with the understanding that all profits above a certain fair return upon the capital invested in the business be shared on a dividend basis with the consumers of the service provided. In championing the theory of control by state commissions he criticised the division of authority now existing between the state commissions, city governments and state legislatures. "If it is necessary to reserve any control for the citizens of the city or the municipal government," Mr. Doherty declared, "then this control should not be of a character to prevent the utility from functioning. I know the cry of home rule is potent, but it should not prevail with thinking people in this instance."



NEW OFFICERS OF RAILWAY AND UTILITIES COMMISSIONERS' ASSOCIATION

Left to right: Front row—Alex. Forward (Virginia), first vice-president; D. N. Lewis (Iowa), president; H. G. Taylor (Nebraska), second vice-president. Back row—J. B. Walker (New York), secretary; J. H. Corbitt (Tennessee), assistant secretary.

The "readiness-to-serve" method of charging was favored by the speaker.

ADVANTAGES OF HOLDING OR INVESTMENT COMPANIES

Martin J. Insull of Chicago, in his address before the commissioners, drew attention to the enormous amount of money necessary in the development of the electric light and power business. In providing these large amounts use is made of holding or, as he expressed it, investment companies. These investment companies raise money on their own securities with which to purchase the junior securities of operating companies. Were it not for this form of financing, he said, many small towns, hamlets and rural districts now enjoying twenty-four-hour electric service would be without any electric service whatsoever.

Owing to the large aggregate purchasing power of such groups of operating companies they can buy machinery and supplies at lowest market prices. In addition, the investment company, through its financial influence and as a result of its credit, can arrange for the placing of the bonds and preferred stock of its operating property on a better basis than the operating companies themselves. It was pointed out that in times of financial stress, when it may be practically impossible for small companies to finance themselves at all, the investment company can provide money temporarily or permanently. This an investment company can do because the risk is so spread and because of its higher credit rating with banks and investment houses and with the investors themselves.

Mr. Insull stated that one of the functions served by the investment company is to stabilize the whole financial structure of the operating companies. Such investment companies must make the other securities, all senior to theirs, secure both as to principal and return before they can earn a cent. They take the chief risk of the business, Mr. Insull said, and are entitled as a result of this risk, as well as through knowledge of the utility business and their responsibility to the investors and the public, to dominate and direct the operating companies they have organized and financed. Without these investment companies with their vast capital, he maintained, it would be practically impossible for a very large part of the population of the country to enjoy the advantages of electric service.

AT THE BANQUET

At the banquet on Thursday evening Carl D. Jackson, retiring president, received as a token of respect from his colleagues a set of platinum and pearl shirt studs and cuff links. The toastmaster, James Schermerhorn, who spoke with no little wit and humor, told of Detroit's experiment with municipal ownership, saying that all the people were led to believe that when once they had municipal ownership their troubles would be ended, but that at the recent election they found out that they had still to spend five million dollars more for extensions, to build a subway, to have the interurban cars stop at the city limits and to shift the paving charges from the Department of Street Railways to the general city expenses, and they were not therefore so sure that their troubles had ended. "But," said Mr. Schermerhorn, "this is an age of experimentation, and if we live through it we shall at least know that we were part of the experiment."

Mr. Jackson said that the commissioners were all interested in watching Detroit. "For Detroit," he said, "may solve what we as commissioners have not yet been able to do—to make money transporting people at less than cost."

The principal address of the evening was made by H. H. Emmons, now president of the Detroit Board of Commerce, who was an officer in the air service during the war.

RESOLUTIONS PASSED

The last session of the convention was concerned chiefly with consideration of resolutions recommended to it by the executive committee. Many of these had to do with railroad regulation. Two of these suggested an amendment of the Esch-Cummins act so that rights and duties of state commissions will be more clearly defined.

Of particular interest to electrical men, however, were two other resolutions, one supporting the indeterminate permit and the other urging uniformity in regulatory laws of the several states.

The first of these, after reciting existing limitations to the possibility of uniform treatment of the utilities on the part of the commissions and the difficulty met by utilities in financing themselves on limited-term franchises, and after stating that the principle of the indeterminate permit goes far toward solving these difficulties, provided ample safeguards be made for the protection of both the public and the investors in the case of the determination of such permits, includes the following clauses:

"Now, therefore, be it resolved, That it is the sense of the National Association of Railway and Utilities Commissioners that the principle of the indeterminate permit is economic and sound and should be adopted in the legislation of the various states relating to public utilities;

"And resolved further, That this association do, and it does hereby, urge the legislatures of the various states which have not as yet adopted the principle of the indeterminate permit to enact legislation recognizing and putting such principle into effect."

The second resolution authorizes a committee of the association "to consider carefully the various forms and practices of utility regulation and report from time to time to this association conclusions and recommendations for a desirable uniform system of public utility regulatory law."

Final decision to hold the next convention at Miami, Fla., Dec. 4, 1923, was reached.

New Power Board Policies

Federal Commission Will Revoke Permits When Delay Is Too Long—Los Angeles Gets License

IN CONNECTION with several cases on which action was taken, the Federal Power Commission at its meeting on Nov. 20 inaugurated two new policies of administration and at the same time was confronted with new questions involving interpretation of the water-power act.

The commission put into effect a policy of revoking preliminary permits in cases where specified engineering investigations are not carried out within a reasonable time. A preliminary permit which was issued on Oct. 12, 1921, to A. Reed Bingham of Pensacola, Fla., looking toward developments on the Perdido, Blackwater and Styx Rivers in Florida and Alabama, was revoked on the ground that stream gaging had not been done as required. A preliminary permit issued March 14, 1922, to J. F. Myser and E. E. Drach of Denver, Col., was revoked because engineering investigations had not been carried out.

Another new policy was marked by the commission's action in waiving the question of valuation and approving a license for the Western States Gas & Electric Company of San Francisco for a constructed project on the Trinity River in northern California, in a national forest. Heretofore the commission has insisted upon valuation being determined before a license was granted. In this case the question of valuation was left for the future and the commission agreed to accept the valuation fixed by the state commission.

Questions of interpretation of the water-power act arose in connection with the application of the city of Los Angeles for a license for its two constructed plants on the city aqueduct about 40 miles north of Los Angeles, affecting both a national forest and public lands. The plants develop about 40,000 hp., which supplies the base-load for the city. The license was granted. This is the first license that has been issued to a municipality. The question has arisen whether the act in providing that licenses shall be issued to municipalities without charge provided the project is to be operated without profits means that such municipality shall be free from all charges under the license or only from administrative charges and that charges for the use of public lands or public structures shall operate against it just as any other concern. No decision on this point was reached. The broad question of "operation without profit" was raised, and although not decided the indications are that the burden of proof will rest upon the licensee to establish that it is not operating at a profit.

Along somewhat similar lines, the question was raised as to proper interpretation of the act in providing that there shall be no charge for licenses for projects of less than 100 hp., the point being whether only administrative charges or all are to be canceled.

Investigation of Radio

N. E. L. A. Committee Delving Into Its Possibilities in Connection with Lighting Circuits

UNDER the chairmanship of N. F. Brady, president of the New York Edison Company, the radio policy sub-committee of the public policy committee of the National Electric Light Association has undertaken an exhaustive study of the "wired wireless" situation, and, in fact, of the entire radio field, in an effort to establish a uniform policy for electric light and power company properties with respect to the radio art.

The committee holds that electric light and power companies of the country are interested in radio from two aspects—radio as it is known today and radio as it may be in future. It feels that today's problems are comparatively simple, in most cases purely mechanical or technical ones dealing with the safeguarding of electric light and power company transmission lines and distribution systems from interference and the simultaneous guarding of radio amateurs from injury or possible death, and the safeguarding of property from damage through thoughtless or careless installations of antennas or unwarranted uses of electric light or power lines.

PROBLEMS FOR SOLUTION

Some of the questions connected with present-day radio practice for which the committee is endeavoring to find an answer satisfactory to the public and the association membership as a whole are:

"Shall the central station get back of the movement and foster radio telephony in the home by installing broadcasting stations and advocating the use of electric lines as antennas?

"Shall it offer the use of its poles for antenna supports?

"Or, on the other hand, shall it discourage the use of socket antenna attachments and foster municipal ordinances restricting and licensing the installation of radio receiving sets?"

The committee feels that there is great diversity of opinion upon these points both from the viewpoint of building good will and from the viewpoint of safety and service standards.

With respect to future developments the committee is now collecting data and having experiments made by leading manufacturers in order to find answers to the following problems and questions, and it confidently expects to have those answers in hand within the next year:

"Will the development of 'carrier current' make possible the use of existing light and power lines for purposes never before contemplated?

"Will the transmission line serve also as a telephone and control channel to communicate with the distant station and to operate its equipment?

"Will the street lights of the future be controlled by carrier current transmitted over the distribution mains?

"Will the radio set of the future operate on the lighting circuits in the home and receive its impulses over the same circuits by means of carrier currents?"

Frequent meetings of this committee are being held in New York, and reports are being received regularly from those conducting the experiments. From time to time announcements will be made by Mr. Brady on behalf of the committee.

Electrical Credit Men Meet at St. Louis

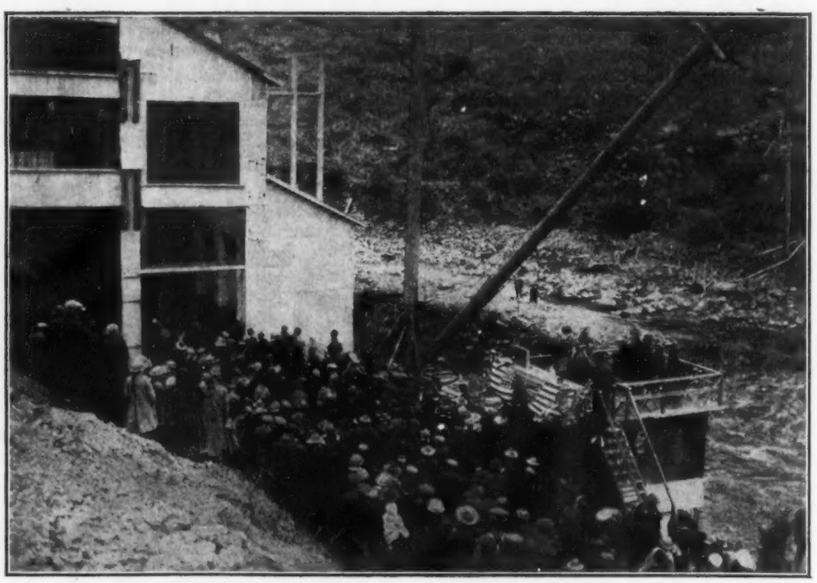
By holding its convention last week at the Statler Hotel, St. Louis, the Electrical Credit Association, Central Division, broke a precedent of twenty-seven years, for during all that period it had met only at Chicago. The program included subjects that ranged from the personal contact of the credit man with his customers and the cheapness of credit to the value of membership in the association. Augustus L. Abbott of the St. Louis bar gave a practical talk on "Credit and Collections Viewed from the Lawyer's Standpoint." At the annual banquet State Attorney-General Jesse W. Barrett delivered an address on "Ethics in the Conduct of Business" and John F. Leahy spoke on the subject of "Electricity and Credits." The attendance numbered two hundred, fifty members coming from territory outside St. Louis. Chicago was represented by twenty-seven.

The total number of claims that were reported on form No. 1 to Nov. 1 was 115,131, involving $1,828,233.29, an increase of 14 per cent in number and a decrease of 20 per cent in the amount involved as compared with the preceding year. The total number of claims adjusted to Nov. 1 was 69,316, involving $6,027,192.25, an increase of 26 per cent in number and a decrease of 18 per cent in amount.

A resolution was passed which authorized the executive committee to spread an assessment not to exceed $5 apiece over the entire membership of the central division in order to provide funds for the National Electrical Credit Association to resume the monthly publication of the national *Bulletin* and the printing of *The Viewpoint*. It was further resolved that, in the judgment of the members of the central division, the members would be willing to pay an annual subscription into the national treasury to insure the regular printing and distribution of *The Viewpoint*.

The following officers were elected for the ensuing year: President, J. H. Taylor, Benjamin Electric Manufacturing Company, Chicago; vice-president, W. Scott Long, Westinghouse Electric & Manufacturing Company, Chicago; secretary-treasurer, Frederic P. Vose; assistant secretary and treasurer, Walter S. Vose; national board member, B. P. George, Beardslee Chandelier Manufacturing Company, Chicago.

California-Oregon Power Company Starts Up Copco Plant



NEARLY 1,500 persons were guests of the California-Oregon Power Company on Nov. 5, when the second generating unit at the Copco hydro-electric plant of the company on the Klamath River in northern California was put into service. The new unit, which is a duplicate of one which has been in service since 1917, is rated at 12,500 kva. and operates under a head of 132 ft. The dam has been raised 14 ft. to give greater head and storage. The dedication ceremony was presided over by John D. McKee, president of the company. A delegation of fifty from San Francisco and twenty-five from the Northwest traveled by special cars to be present at the opening. In addition more than a thousand people came in their cars from 60 miles around.

Education of Employees

This Topic Forms the Keynote of the N. E. L. A. Commercial Bureau Meetings Held at Boston

STEPS toward the better education of the rank and file of central-station employees and new courses for the more experienced ones were outlined last week at the meetings of various bureaus of the Commercial Section of the National Electric Light Association at Boston. Progress in illuminating engineering, advances in electric vehicle application and improvements in wiring practice and facilities also received detailed attention at these meetings, which occupied the greater part of three days, with headquarters at the Hotel Somerset. At times five simultaneous sessions were under way.

At the opening session on Nov. 15 of the Lighting Sales Bureau, G. Bertrand Regar presiding, R. S. Hale, chairman of the wiring committee, announced that the National Electrical Code committee had just approved an allowance of 15 amp. per branch circuit and the use of the solid neutral. A long discussion of the desirability of stimulating ornamental street lighting by the co-operation of local electrical leagues followed. It was the general opinion that contracts for such service should always be made with municipalities, owing to heavy losses frequently entailed through the irresponsibility of merchants' associations.

Preston S. Millar, New York, outlined a plan for training lighting specialists in central stations which will probably go into effect in the near future. Lectures on better lighting are also to be given shortly at the Armour Institute, Chicago, under the auspices of the Illuminating Engineering Society, for the particular benefit of architects. The importance of training contractors to lay out better lighting work was emphasized, and instances were cited of the benefits of illuminating engineering in connection with outputs and revenue. Floodlighting of windows to overcome daylight reflection was discussed. J. Daniels, Boston, said that the local Bureau for Better Illumination had stimulated more new business than can quickly be handled.

ELECTRICALLY EQUIPPED FURNITURE

Within three months important new fittings for electrically equipped furniture will probably be on the market, the Hubbell and General Electric companies having designed attachments with multiple outlets which can be applied by the residence customer to furniture without the aid of a wiring contractor. Tests are to be made of the capacity of No. 18 cord for 15-amp. service. If it overheats, it appears that No. 14 cord with special fittings may have to be used; otherwise standard attachment plugs and cords will suffice.

F. R. Jenkins, Chicago, announced a new commercial course for central-station men, contractor-dealers, jobbers' salesmen, etc., which will impart the fundamentals of salesmanship, public relations, rates, wiring and electrical principles. With C. E. Skinner presiding, E. S. Mansfield, Boston, announced the particulars of a factory course in electric transportation for central-station power sales engineers, which will in a measure parallel the industrial electric heating courses given of late under the auspices of the National Electric Light Association.

An electric vehicle luncheon was held on Thursday noon under the auspices of the Electric Vehicle Bureau of the New England division. More than 1,000 new electric vehicles have been purchased in the New York district within the past eighteen months, adding 6,000,000 kw.-hr. per year to the central-station load. A. Jackson Marshall, W. L. Goodwin and H. A. Lane, New York, spoke about the work of the Joint Committee on Business Development and the co-operative efforts of the N. E. L. A. and the Society for Electrical Development, and on behalf of the Electrical Supply Jobbers' Association and the National Association of Electragists Harry Grant and A. J. Hixon pledged their co-operation in the enlargement of the industry's business.

R. S. Hale outlined the work of the testing sub-committee of the wiring committee at the closing session on Friday. The next meetings of the Commercial Section bureaus will be at Denver, Col., Jan. 24-26, 1923, at the offices of the Denver Gas & Electric Light Company.

A. I. E. E. Adds "Liaison Officer" to Its Staff

The board of directors of the American Institute of Electrical Engineers at its regular meeting last month approved a recommendation of its special committee on headquarters personnel that a qualified man be added to the staff of the Institute to perform the duties outlined by the committee in a resolution suggesting administrative plans and concluding as follows:

"To carry out these plans, it is, in our opinion, desirable to add to the staff a thoroughly competent man, who can act, for example, as the secretary of the meetings and papers committee and as liaison officer between that committee and the various sections, thus being in a position to offer good papers to various sections as opportunity occurs and to arrange with the authors for the presentation of their papers at such meetings, thereby relieving the crowded programs of the limited number of general conventions of the Institute. The duties of this employee would naturally include close co-operation with the publication committee, inasmuch as all the papers and discussions presented both at section and Institute meetings are, in accordance with the policy already adopted, equally available for publication in the *Journal*. Furthermore, it is generally agreed that the publication of an increasing number of the papers presented at section meetings will be a large factor in raising the standard of section meetings."

N. E. L. A. Wiring Committee Making Progress

Great satisfaction in the acceptance by the National Electrical Code committee of the solid neutral and 15-amp. branch-circuit fuse recommendations marked the meeting of the N. E. L. A. wiring committee at the Harvard Club, Boston, on Nov. 16. Chairman R. S. Hale presided. Discussing the polarization and grounding of the frames of portable devices, it was found that no one seriously suggested grounding flatiron frames or those of percolators, toasters, etc., but that occasionally rules are suggested that seem to indicate that this might be required. The consensus of opinion was that to attempt to have a third wire for the frames of devices like flatirons is entirely unnecessary.

On heater cords recent tests indicate that a standard test for durability, inflammability and conductivity is practicable, and it was decided to have about ten cords tested and the results published without the names of the makers, thus furnishing at least a basis of comparison. Steps were taken to prepare a report on the relationships between central-station companies and wiring contractors. The committee has under consideration the determination of the minimum quantity of wiring that should permit a house to be properly described as wired, the dissemination of data on the advantages of unit prices for wiring, the determination of the advisability of locating service switches for the convenience of police and firemen, and the safety of running the neutral of a grounded system bare when mechanically protected, as in rigid conduit.

Majority of 25,000 Against South Dakota Project

Although complete returns on the defeat of the proposal for state development and operation of a hydro-electric plant on the Missouri River near Mobridge, S. D., are not yet available, it is estimated that the measure lost by about 25,000 votes. State construction of a system of transmission lines to serve cities and towns in the eastern part of the state was involved. To do this the voters were asked to authorize an issue of $16,000,000 of bonds. It was admitted that the estimates of the state's engineers showed that the project could not possibly approach a self-supporting basis for a number of years. Undoubtedly the unsuccessful experiments in the operation of industries in North Dakota made by the Non-partisan League were a powerful factor in convincing the people of South Dakota that they should not become entangled with political ownership of the electric light and power industry.

Columbia River Power

Its Development Held by Engineering Board to Be Secondary to Irrigation Plans

THE majority and minority reports on upper Columbia River water power made by a board of engineers appointed at the instance of the Federal Power Commission will be available for distribution before the end of the year. Among the conclusions of the majority report are these:

Freedom should be given to fullest irrigation expansion in Montana, Idaho and Washington, and no rights should be allowed to accrue to lower interests which would legalize limitation of or interference with irrigation above.

The Columbia Basin gravity project can be adequately supplied by the aid of storage in Pend Oreille and Priest Lakes in Idaho, conditioned upon maintenance of natural flow from Flathead Lake when needed.

Information upon which to base a final decision between a gravity and a pumped supply for a Columbia Basin irrigation project should be completed. Any decision should take into account the effect upon potential power. Pending such decision no permament rights of storage should be granted in Pend Oreille and Priest Lakes. If ultimately the decision is in favor of a Columbia Basin gravity project, storage rights in Pend Oreille and Priest Lakes should be granted to such project, but should be limited to storage of inflow in excess of 7,000 second-feet. If ultimately the decision is in favor of a Columbia Basin pumping project, storage rights in Pend Oreille and Priest Lakes should be granted to the joint power interests on the lower Clark Fork and the Columbia River, subject to limitations in the interests of irrigation.

Storage rights in Flathead Lake should be granted to Flathead power interests, subject to the fullest development found practicable after complete investigation. Prior to such development rights may be advantageously granted to power interests on Clark Fork subject to conditions protecting ultimate control for Flathead power and natural-flow release when needed for the protection of the Columbia Basin project if built on the gravity plan.

A permit to develop power at the Grand Coulee site or at any point on the Columbia River as far downstream as the Foster Creek site should not be granted to power interests until it is known that such site will not be needed by the Columbia Basin project.

MINORITY REPORT CRITICISES BOARD

The minority report, submitted by Marvin Chase, Supervisor of Hydraulics for the State of Washington, takes vigorous exception to what is alleged to be an effort on the part of the Federal Power Commission to exceed its authority and declares that the commission should recognize the superiority of right for irrigation inhering in this project and should grant no power rights which might conflict with irrigation projects. The Columbia River Board, Mr. Chase holds, has evaded its duty by not recommending an arrangement of power development on the Flathead, Clark Fork, Spokane and upper Columbia River which would yield the maximum commercial power, near existing and probable markets, subject to the superior use of the waters for irrigation of the greatest possible area. The State of Washington, he says, having officially adopted the gravity project for the reclamation of the Columbia Basin lands, the Federal Power Commission should not become involved in any controversy as to other possible means of reclamation, but should co-operate with the state to forward the early development of this area, thereby creating new power markets and leading to the maximum utilization of the water resources of the Columbia River.

California Electrical Co-operative Campaign Plans

The advisory committee of the California Electrical Co-operative Campaign at a meeting held in San Francisco on Nov. 10 decided that in 1923 it would double its effort to promote electrification of homes. Data furnished by the state housing committee indicated that thirty thousand residences will be erected in California next year. An intensive drive will be made to electrify all these homes. With this object it is hoped to build ten model electric homes in as many strategically situated cities, and an effort will be made to reach one-tenth of the entire population of the state, particularly that portion interested in home building.

The central-station companies are greatly interested in the movement because its success will, of course, mean enlarged business for them. It is even estimated that with proper education the occupants of these new homes may be induced to increase their use of electrical energy from the present average of 250 kw.-hr. a year to somewhere between 2,000 kw.-hr. and 3,000 kw.-hr. a year. On what is held to be a conservative basis the additional consumption of energy will reach 30,000,000 kw.-hr., which at an average rate of 2 cents per kilowatt-hour means an additional gross revenue for the electric light and power companies of the state totaling $600,000.

To the manufacturer, jobber and contractor-dealer the campaign is also of outstanding interest. It is thought reasonable to expect that the average expenditure for wiring and electrical equipment of the new homes will be raised from the former average in California of $250 to $500, thus making possible an additional market for electrical merchandise in 1923 of $7,500,000.

The entire staff of the California Electrical Co-operative Campaign will be almost doubled, and a thoroughly organized effort will be made in every nook and corner of the state.

Sloan Talks on Publicity

In Notable Address to Newspaper Men, Head of Brooklyn Edison Urges the Value of Utility News

AN ADDRESS that attracted more than ordinary newspaper attention was given before Westchester County (N. Y.) journalists and representatives of public service corporations last week at the Westchester-Biltmore Country Club, Rye, N. Y., by M. S. Sloan, who is at the head of the New York State Committee on Public Utility Information as well as president of the Brooklyn Edison Company. Among other things, Mr. Sloan said:

"Our business with its great investment and widespread service, which touches so very intimately the domestic, social, commercial and industrial life of the people, is a matter of concern to the public, and the public are entitled to know about it. They should be informed about our organization, income, needs and possibilities. We should tell them about the bigness, the importance, the necessity, the growth and development of our business; about the payroll, the amount of materials purchased and taxes paid; about the physical condition of the properties, and about the stability and permanency of our business. Few other American industrial operations can show such a record of stability and fundamental soundness.

INFORMATION DUE TO PUBLIC

"We should tell why we are natural monopolies, of the demands for our service, the importance of our companies to the communities, how we are financed, how the utilities are taking the customer into partnership or ownership of our properties, our obligation to furnish good, adequate and continuous service at fair and reasonable rates, and the steady demand for new necessary capital in our business in order that we may keep up with the progress and growth of the various communities in which we operate.

"We believe that our committee, which collects facts about the industry and makes them available to the newspapers in regulation newspaper form, is in some degree at least a service to the newspapers. The reception our matter has had generally among the newspapers in the state seems to justify that belief.

"The committee is working along two other lines. It is endeavoring to establish a condition where each individual company will give out its own local news items, where it will see to it that each newspaper in the community in which it operates is informed of any event of general interest which happens in the business life of that company. We believe this is due the newspapers as news-gathering organizations and to the public which they serve. Moreover, we are endeavoring to show to the companies the advantage of more extensive and more regular and continuous advertising. Each company has

many things to tell its customers which are of interest to them and of importance to the community. These things, however, are not always news items or information of a character which a newspaper could or should print in its news or editorial columns. Space for information of this nature should be paid for as a matter of business, and it is good business for the companies to buy space in order to tell these things to the public.

"Behind the investments in utilities there is a history of human study and investigation and achievement in all the sciences, of improvement in service rendered and in accuracy of performance, and of a growth of and demand for a necessity that is not yet ended. The world can never think how to live without the utilities again. They are the very heart of every community, furnishing a vitally necessary service as cheaply as human skill and brains and experience permit.

NEED HELP OF COMMUNITIES

"The communities need us and by the same token we need the communities. We need their understanding of our business, our problems and our ideals. I do not know a single utility executive who is not animated by a genuine ideal of public service.

"We know that the prosperity of every institution patronized by the public is dependent upon the good will of the people. Good will is the most valued asset of any business. It follows prestige, which is reputation for excellence of performance. We fully acknowledge that it is our duty to give the best and most efficient service, and we know by doing this we best serve the public, our stockholders and the interests committed to our charge.

"What we seek is the genuine friendship of our customers, built on a knowledge of exact facts and understanding of our business, and we are willing to go as far toward the other fellow as we know how. That is, as briefly as I know how to tell, the reason for the existence of our committee."

Salt River Water Users Contend Before Commission

The Federal Power Commission at an early meeting will consider the application of F. G. Baum of San Francisco covering a project on Black River in eastern Arizona. He plans to develop power for the Silver City (N. M.) mining area at that point. Objection is being offered to Mr. Baum's application by the Salt River Water Users' Association. This organization contends that the two or three reservoirs which Mr. Baum proposes to build 150 miles above the Roosevelt Dam will diminish the water supply at the dam by increasing evaporation and seepage losses. The power applicant and his engineers have submitted arguments and data to show that the reverse will result. Regulating the flow of the Black River, they contend, will prevent waste of water in the years when the supply is greater than can be stored at the Roosevelt Dam and in the dry years will increase the amount of the water available below.

Particular significance is attached to this situation as it is typical of many others. In this case the Salt River Water Users' Association has been able to postpone action in the matter at least six times. Many applicants are anxious to see the Federal Power Commission adopt a policy which will dispose promptly of such protests, otherwise it is feared that the users of water on the lower stretches of the river will continue to make protests and delay power developments above.

Brief News Notes

Hornell May Get Niagara Power.—An option on the controlling stock of the Hornell (N. Y.) Electric Company is said to have been taken by a representative of E. L. Phillips & Company of New York City, owners of plants in several New York State communities. Plans to bring Niagara power to Hornell are said to be in contemplation.

Water-Power Applications Fall Off.—During the year ended Oct. 31 ninety-six applications for licenses and preliminary permits were received by the Federal Power Commission. This is a material decrease, for in the first sixteen months of the commission's existence 260 applications were received. It is estimated that applications in the future will be received at a fairly constant rate of about seventy-five annually.

New Japanese-American Cable Is Planned.—The Japanese government has asked the Diet for an appropriation to construct a new cable between the Island Empire and America. If the Diet refuses to grant the necessary funds, it will be asked to authorize the government to contract with a private concern to construct the cable. A business group headed by Baron Shibusawa is said to be ready to undertake the work.

Engineering Division of National Research Council Issues Booklet.—The division of engineering of the National Research Council has just issued a booklet giving much information about its organization, the work done and contemplated, and containing its by-laws and lists of its officers, committees and members. Copies of the pamphlet may be had from Alfred D. Flinn, chairman, or William Spraragen, secretary, 29 West Thirty-ninth Street, New York.

"Service" the Unique Name of Kansas Town.—"Service" is the name of the newest town in Kansas—a town which will be built by the Kansas Gas & Electric Company adjacent to the power house it plans to construct east of Parsons on the bank of the Neosho River. Not only does Kansas contain no other town by that name, but there is no such post office in the entire United States. Work already has been started on the steel-tower transmission line between El Dorado and the site of the new plant.

Radio Saves the Day and Moves Trains.—Saturday, Nov. 4, found northern Colorado and a zone about 60 miles wide in every direction from Cheyenne, Wyo., in the throes of the season's first blizzard. Several hundred telegraph poles were blown down, and wires were broken in thousands of places. The railroad company at Cheyenne lost track of several trains and appealed to the Cheyenne radio mail service, for help. The trains were quickly located by wireless and normal service restored.

Newspaper Radio Service Grows.—For the first time in history, radio telegraphy was utilized this month to transmit a full press association news report across the continent. Owing to severe sleet, snow and wind storms in the Rocky Mountain region and the crippled service on land lines, the International News Service transmitted a full election service from New York to San Francisco by wireless through the co-operation of the Radio Corporation of America. The service was reported to be as fast as that obtained over land lines under ordinary conditions.

Detroit Edison Stock Holders Approve Fifteen-Million-Dollar Issue.—More than 73 per cent of the stockholders of the Detroit Edison Company voted at a special meeting in favor of an issue of $15,000,000 of 6 per cent ten-year convertible debenture bonds. Following the meeting, directors offered to the stockholders rights to subscribe to the debenture bonds equal to 20 per cent of their holdings of record on Nov. 20, 1922. The debenture bonds so offered will be dated Dec. 15, 1922, and will be convertible at par at the option of the holders into stock.

San Francisco to Have New Central-Station Office Building.—The Pacific Gas & Electric Company has announced plans for the construction of a seventeen-story office building at Beal and Market Streets, San Francisco. The building will cost about $1,500,000 and will be the third highest office building in that city. An auditorium will be provided on the ground floor with a seating capacity for five hundred people. On the top floor social rooms for the employees will be provided. The date of starting construction has not been set.

New Power Plant of Counties Gas & Electric Nears Completion.—Rapid progress is being made on the Barbadoes Island electric power plant of the Counties Gas & Electric Company of Norristown, Pa., and announcement is made that the first unit will probably go into operation in January. This unit, which will eventually be one of five, is rated at 25,000 kva. It will be steam-driven with a very small augmentation from water power developed in the Schuylkill River, which is not expected to exceed 750 hp. maxi-

mum and will average about 300 hp. The station in its ultimate form will be one of the largest in Pennsylvania.

Lafayette Electrifies Its Pumping Plant.—The municipal water plant at Lafayette, Ind., is to be operated by electric power. At the main and auxiliary pumping stations steam power now is used. The equipment is old and it would cost a large sum to replace it. The city has arranged with the Northern Indiana Gas & Electric Company to provide energy at a low rate and new apparatus will be brought to operate the pumps. The electrical equipment will be so arranged that the city can add a generating unit at any time, the Mayor asserting that by this means the city will be able to generate ts own energy for street lighting should this prove desirable.

C., M. & St. P. Considering Electrification of Mississippi Division.—According to a statement made in an address to the Kiwanis Club at Sparta, Wis., by A. C. Crandall, commercial and purchasing agent of the Wisconsin-Minnesota Light & Power Company, negotiations have been opened between that company and the Chicago, Milwaukee & St. Paul Railway Company to provide total electrification of the Mississippi division of the railroad. The Wisconsin-Minnesota company has available at present to meet such a demand, Mr. Crandall said, 60,000 hp. from its five-million-dollar Wissota water-power plant.

Los Angeles Moves to Take Over Private System.—Steps have been taken by the city of Los Angeles to institute condemnation proceedings for the purpose of taking over the generating plant and distribution system of the Los Angeles Gas & Electric Corporation. This action follows failure of the city and the company to agree upon a basis of sale. The private utility's system is said to be worth between six and seven million dollars. It consists of a generating plant of approximately 70,000 hp., five substations and a distribution system covering the main body of the city and supplying between 25 to 30 per cent of the electricity used in Los Angeles. Engineers for the city estimate that the acquisition of the private system will add to the revenue of the city nearly $1,000,000 a year.

To Bring Government and Commercial Specifications Into Harmony.—An important step toward the elimination of the differences between specifications for government purchases and the usual specification practice of commercial suppliers, differences responsible for the saying common in commercial circles that it costs 10 per cent more to do business with the government than with other customers, has been taken through the appointment by the American Engineering Standards Committee of a standing committee on co-operation with the Federal Specifications Board. Work carried out under the general direction of this committee will give industry, it is believed, a better opportunity to participate in the development of specifications for government purchases. It will at the same time bring to the government, to a greater degree than has heretofore been possible, the talent of the two hundred industrial organizations co-operating in the work of the American Engineering Standards Committee.

Build 130 Miles of Transmission Line in Six Months.—A few days prior to the opening of the California-Oregon Power Company's Copco plant the new 130-mile transmission line between Springfield, Ore., and the company's Prospect plant, built in the record time of six months, was placed in operation. This added a northern extension of nearly 200 miles to the interconnected transmission system of the West, already the greatest in the world. This interconnected system now extends a distance of more than 1,300 miles from the Mexican border on the south to Albany, Ore., on the north. The line is designed for 110,000-volt operation and was constructed to deliver power from the system of the California-Oregon Power Company to that of the Mountain States Power Company, which serves the towns in the upper Willamette Valley in Oregon.

Another Remarkable Photograph.—The peculiarity of this picture, taken by Lawrence B. Philpot, an electrical

engineer of Vancouver, British Columbia, will be seen to be that the lightning flash is apparently made up of a multiplicity of small discharges, giving the appearance of a dotted line. The photograph was taken with a stereoscopic camera, and there is no doubt that the picture is a true one of an electrical discharge.

United States Supreme Court Will Review Southern Power Case.—The Supreme Court of the United States has granted a writ of certiorari by which the Southern Power Company may appeal from the decisions in suits brought against it by the North Carolina Public Service Company and the cities of Greensboro and High Point, N. C. The cities and the public service company, which resells electrical energy furnished it by the Southern Power Company, sued the latter company to compel it to continue supplying electrical energy under expired contracts. A question of jurisdiction arose between the state and federal courts, but the latter finally assumed jurisdiction. The lower court held that the power company could not be compelled to continue the sale of energy for general distribution, especially for domestic use, but that it should continue to supply motive power for the street railways of Greensboro and High Point.

Associations and Societies

Wisconsin State Contractors.—The annual convention of the Wisconsin State Association of Electragists will be held at the Hotel Pfister, Milwaukee, on Jan. 24, 25 and 26, 1923.

American Physical Society.—The one hundred and seventeenth regular meeting of the American Physical Society will be held in Chicago on Saturday, Dec. 2. There will be sessions also on Dec. 1 if the length of the program requires it. The annual meeting of the society will be held at Boston on Dec. 26-30 and subsequent meetings at New York on Feb. 24, 1923, and at Washington on April 21.

Utility Accountants Hold Conference at Eau Claire.—Electric and other utility companies of Wisconsin sent the heads of their accounting and auditing departments to the first conference of the accounting section of the Wisconsin Utilities Association, held on Nov. 22 and 23 at Eau Claire for the purpose of discussing the new classification of accounts prescribed by the Railroad Commission and other accounting problems. George C. Mathews, chief statistician of the Wisconsin Railroad Commission, was announced as the principal speaker.

Coming Meetings of Electrical and Other Technical Societies

A complete directory of electrical associations is published in the *Electrical World* in the first issue of each volume. See July 1 issue for latest list.

American Physical Society—Chicago, Dec. 1 and 2. D. C. Miller, Case School of Applied Science, Cleveland.

American Society of Mechanical Engineers—New York, Dec. 4-8.

Electrical Supply Jobbers' Association, Pacific Coast Division—Coronado, Cal., Dec. 7-9. A. H. Elliot, 502 Flatiron Bldg., San Francisco.

New York Electrical Credit Association—New York, Dec. 14. W. J. Kreger, 47 W. 34th St., New York.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Commission Rulings

Arbitrary Discontinuance of Service Forbidden.—By ordering the San Diego Electric Railway Company to restore service on Adams Avenue, in the city of San Diego, the California Railroad Commission has ruled that no utility can arbitrarily discontinue its service and withdraw property voluntarily dedicated to public use. A dispute had arisen between the company and the city over the tearing up of about three-quarters of a mile of single track.

No Return Allowed on Property Donated by Patrons.—No return should be allowed an electric utility on the value of property contributed by its consumers when no interest is paid to the consumers for such use, according to a decision of the Wisconsin Railroad Commission in a case affecting the Rio Electric Company. The return was computed upon the company's equity only, but since it was the obligation of the company to maintain and replace all the physical property when worn out the entire value was used as the base on which to compute allowances for retirement expense and for taxes.

Underground Service Not Required in Residential District.—In view of the lower cost of overhead service in a residential district in the Charlestown section of Boston, the Massachusetts Department of Public Utilities has refused to grant the petition of Smith vs. Charlestown Gas & Electric Company for underground service in the Bunker Hill district. The company was willing to supply overhead service, but the petitioner objected to the installation of poles and outside wires, on the ground of appearance. There are few if any underground conduits in the district, and the commission declared its belief that the residents of the region affected would rather obtain service by overhead lines at less cost than pay more for underground runs.

Commission's Power to Raise Rate Above Franchise Limitation.—In approving a service-at-cost contract entered into by the Rochester street railway with the municipality, the New York Public Service Commission said, in answer to an objection raised that it could not permit the fare to be raised above the limitations imposed by the company's franchise: "This raises a question of law which must be submitted to the proper tribunal for determination. . . . The amendment to the Public Service Commissions law expressly gives the commission power to approve a service-at-cost contract as defined by the act, or any agreement purporting to be such a contract. It may, however, be fit and proper for this commission to state that it knows of no rule of law which forbids parties to a contract, even though one be a municipal corporation, from modifying by mutual consent the terms of their contract. . . . The amendment of 1921 empowered the commission to determine just and reasonable rates, notwithstanding that a higher or lower rate had been theretofore prescribed by statute, grant, franchise or other agreement."

Municipality Must Not Ask for One Certificate Covering Two Separate Enterprises.—The municipality of Crook, Col., having asked for a joint certificate of convenience and necessity covering extensions to both its electric and its waterworks plant, the Colorado Public Utilities Commission refused the application, pointing out that neither should an electric utility be financed from waterworks funds nor a water utility from electric department funds. Application, it insisted, must be made separately.

Capitalizing a Deficit.—A sum representing a capitalized deficiency in earning an amount necessary to represent the accrued depreciation figured upon the property of a street-railway company was allowed by the New York Public Service Commission against the protest of the municipality concerned in a case affecting the New York State Railways. The commission held that the decision of the United States Supreme Court in Galveston Electric Company vs. Galveston did not apply and said that it could not undertake to reduce the rate base by the capitalized sum involved, in the face of conflicting interpretations of the law, until the entire valuation had been reconsidered.

Approval of Security Issues Withheld on Ground that They Would Mean Disproportion Between Bonds and Stock.—The New Jersey Board of Public Utility Commissioners has withheld approval of proposed security issues by the Commonwealth Electric Company of Summit, the Commonwealth Water Company and the Lakewood & Coast Electric Company on the ground that such issues would make the total par value of outstanding bonds equal approximately 80 per cent of the securities outstanding, the stock representing only 20 per cent. The board ruled that it would give consideration to applications representing 70 per cent of the value of the property and stock to the amount of 30 per cent.

Would-Be Customers Cannot Be Forced to Buy Stock as a Condition of Service.—The Board of Railroad Commissioners of South Dakota has forbidden the White River Telephone Company to make the purchase of stock a condition precedent to furnishing service. In this connection the commission said: "The reason for the company's position is perfectly obvious, and it is easily understood, where a number of farmers band themselves together for the purpose of securing telephone service and where they by their own efforts alone have built a telephone system, that they should desire each and every subscriber for service thereon to invest a sum equal to that invested by them individually. While we appreciate fully the attitude of the company in this regard and realize that in many cases it is desirable and in the interest of all concerned that the intending subscriber, if he is in a position to do so, purchase stock in the company, such purchase, however, must be voluntary."

Recent Court Decisions

No Appeal to Supreme Court Permitted Where Commission Grants Permit for Dam.—In Royal Glen Land & Lumber Company vs. Public Service Commission of West Virginia it was attempted, because of alleged errors in the award, to force the suspension of a commission order awarding a permit to the Community Power Company to construct a dam across the south branch of the Potomac River for hydro-electric purposes. The Supreme Court of Appeals of the state disavowed jurisdiction, declaring that under the statutes of West Virginia no direct appeal to it could lie. (113 S. E. 749.)*

Highest Court Decrees that Changes of Rates Must Be Based on Findings of Injustice or Discrimination.—Orders of the Kansas Public Utilities Commission changing rates to be charged for service must be predicated upon findings of fact that rates are unjust or discriminatory, according to a decision of the United States Supreme Court rendered Nov. 13. The decision enjoins surcharges granted by the Kansas commission to the Kansas Gas & Electric Company in 1918. The suit was instituted by the Wichita Railway & Light Company, which won in the District Court, lost in the Court of Appeals and has finally won in the Supreme Court. The Wichita company in 1910 entered into a contract for electricity with the Kansas company, to run until 1930. In December, 1916, the Kansas company filed a lower schedule of rates for its general business and put them into effect in 1917. Later it filed a petition claiming heavy loss owing to increased expenses and asked that further enforcement of its lowered schedule be stopped and that a graduated surcharge be imposed for consumption in excess of 100 kw.-hr. per month. The commission made changes in the proposed surcharge schedule and granted the new rates. The Wichita company filed suit for an injunction, charging that it was the heaviest single purchaser of electrical energy from the Kansas company and that the surcharge reached it alone in its highest form. The decision of the Supreme Court declares that the Wichita company was deprived of just redress when the commission acted without going fully into the facts and establishing that the existing rates were of an inequitable character.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

D. N. Lewis President Railroad and Utilities Commissioners

It is a rare thing in America for a man to train for public office, filling subordinate posts with ability and devotion, and finally reach a position of responsibility and honor. Too often men appointed or elected to political office owe their success to other accomplishments. Not so, however, in the case of Dwight N. Lewis, a member of the Iowa Board of Railroad Commissioners, who has just been elected president of the National Association of Railroad and Utilities Commissioners. For twenty-five years he has been connected in one form or another with the Iowa commission. A lawyer by profession, he entered the employ of the commission twenty-five years ago, when he was the whole office force in charge of its accounting, secretarial work, rate work and reporting. He went into training as a commissioner right then and gradually advanced to be secretary and later counsel for the commission, holding the latter position for six years. He was then appointed a member of the body to fill out an unexpired term and was elected in 1918 for a four-year term. He has just been re-elected for another four-year term by one of the largest Republican majorities in Iowa, 200,000.

D. N. LEWIS

Mr. Lewis is noted for his thorough and consistent work as commissioner. The chairman of the commission, Charles Webster, says they think so much of Lewis because he does all the work. Not only does he stand high in the estimation of Iowans, but also in the estimation of every public service commissioner in the United States. For twenty-three years he has been a member of the national association, and he has done an immense amount of committee work and all the other things which go to make association activities useful. The election of Mr. Lewis at Detroit to the presidency of the association for the ensuing year was one of the most popular selections which that association has made.

Mr. Lewis is a native Iowan and was graduated from the Drake University Law School at Des Moines. He has high ideals as to the duties of public service commissioners in the regulation of public utilities for the adequate service of the public.

C. G. Schluederberg to Study Business Conditions in Orient

Carl G. Schluederberg, assistant to the managers of the supply and merchandising departments of the Westinghouse Electric & Manufacturing Company and special representative of that company in foreign countries, left recently for a four months' trip in the Orient to study business conditions. Mr. Schluederberg will visit Japan, the Philippines and China to make a sales survey, investigating especially the possibilities of expansion of the market for household appliances. Not long ago he spent three months in South America investigating electrical merchandising conditions there.

Westerners Traveling East

Quite a number of executives from the Pacific Coast are at present in the East and others will shortly be en route. J. B. Miller and R. H. Ballard, president and vice-president and general manager respectively of the Southern California Edison Company of Los Angeles, and Mortimer Fleishhacker of the Great Western Power Company are at present in New York. Others who expect to be in New York in a week or so are W. E. Creed, president of the Pacific Gas & Electric Company of San Francisco, and F. T. Griffith, president of the Portland (Ore.) Railway & Light Company. Most of these will stay over for important meetings at N. E. L. A. headquarters early in December.

E. W. Rice, Jr., honorary chairman of the board of directors, and Dr. W. R. Whitney, director of the research laboratory, of the General Electric Company, sailed yesterday on an extended European trip, during which they will visit various universities and industries in England, France, Italy, Switzerland, Germany, Denmark and other lands. Their first stop will be made in England, where they will remain for some time, visiting universities to get in touch with men doing research work and also inspecting research laboratories in various industries. They also expect to find much of interest in Denmark. They will be gone four or five months.

General Harbord to Head Radio Corporation

Major General John G. Harbord, Deputy Chief of Staff and one of the distinguished officers of the United States Army, will retire on Dec. 29 to become president of the Radio Corporation of America, succeeding Edward J. Nally, who has resigned the presidency to become the corporation's managing director of international relations, with headquarters in Paris. Army circles and official Washington in general say the corporation could not have obtained a more fitting man for its head. Equipped with a college education, General Harbord enlisted as a private in the army at twenty-three years of age and has reached his present position through sheer merit. He is a former Rough Rider, a veteran of war in Cuba and the Philippines, was chief of staff under General Pershing in France and later in command of the marines at Château Thierry. He was made a major-general, and in 1918 he commanded the service of supply responsible for all the supplies of the A. E. F. In May, 1919, he was reappointed chief of staff, and he served as such until sent by President Wilson to the Near East as chief of the military mission to Armenia. He has been deputy chief of staff since June, 1921. General Harbord will leave Washington about Dec. 15 and will take charge of his new duties with the Radio Corporation on Jan. 1. The post to which he has been elected is regarded as of vital importance to the government as well as to the public since the Radio Corporation was formed at the suggestion of representatives of the United States Navy in order that worldwide wireless communication, free from foreign domination, might be built up under American ownership and control.

J. G. HARBORD

R. A. Lundquist Returns from Europe

After an absence of over three months, during which time he visited the Scandinavian countries, Germany and Great Britain, R. A. Lundquist, chief of the electrical equipment division of the Bureau of Foreign and Domestic Commerce, will return to his work in Washington in the near future. Mr. Lundquist has made a careful study of the market conditions for electrical goods in Sweden and Great Britain and will have interesting news for the American electrical industry regarding these countries. His investigations in Germany were directed more with regard to the competition which the German exporters are offering in foreign markets.

Henry Schade, who for a number of years has been manager of the electric store for the Portland Railway, Light & Power Company, has been made manager of the investment department.

George McClellan, for two years manager of the Southern Wisconsin Electric Company at Walworth, Wis., has been made assistant general superintendent of the company with headquarters at Lake Geneva. Elmer Ravin of Delavan, Wis., who has been with the company for four years, is the new manager at Walworth.

R. L. Beers has recently been appointed chief engineer of the Detroit Stoker Company, Detroit. Four years ago Mr. Beers was appointed testing engineer of the Underfeed Stoker Company of America and was later promoted to the position of assistant chief engineer. In his new position he will be in direct charge of the design and application of the Detroit Stoker Company's single-retort and multiple-retort underfeed stokers.

James G. Hogan, sales manager of the Empire District Electric Company in Joplin, Mo., has been promoted and transferred to the position of power engineer for the Ohio Public Service Company in Cleveland. The plant of which he will have charge serves Cleveland, Massillon, Mansfield, Lorain, Elyria, Alliance, Ashland, Orrville and other places in that state. Mr. Hogan will take up his new duties this month. He has been with the Empire company at Joplin five years.

Theodore Randolph Norris, who has been in charge of the engineering department of the Monongahela Power & Railway Company at Clarksburg, W. Va., for five years, has been promoted to the position of superintendent of the company's properties in the Clarksburg district. Mr. Norris will be in charge of railways, succeeding J. I. Beals, general superintendent, who has been transferred to the Fairmont office. A native of South Carolina, Mr. Norris spent his early days in that state. Later be became associated with a railroad at Erwin, Tenn. He is considered one of the best engineers in the country, and in connection with his engineering work he has had considerable experience in general railway and traction company operation.

F. J. McEniry Appointed Representative of Electrical League

Frank J. McEniry, vice-president of the Denver Press Club and for several years a staff member of the *Rocky Mountain News* in Denver, has been appointed field representative of the Denver Electrical Co-operative League. He

F. J. McENIRY

will assist S. W. Bishop, executive manager of the league, in an intensive campaign for closer co-operation between the public and the central station, jobbers, contractor-dealers and manufacturers. Mr. McEniry is a graduate of the University of Denver and has a large acquaintance in Denver and throughout the state.

R. C. Lightcap, chief clerk in the treasury department, was elected an additional assistant treasurer of the West Penn Power Company and West Penn Railways Company last month. Mr. Lightcap became associated with the West Penn system in 1907, when he entered the accounting department. Two years later he was transferred to the department handling irrigation projects, which was segregated from the West Penn companies in 1913. In 1916 Mr. Lightcap re-entered the service of the West Penn as chief clerk in the accounting department, a position he held for two years. In 1918 he became a clerk in the treasury department and was made chief clerk a year later.

Sidney W. Farnsworth has been appointed to the recently created position of chief engineer of the United States Post Office Department. Mr. Farnsworth was graduated from Worcester Polytechnic Institute in 1906 and became associated with the Underwriters' Laboratories, Chicago, in 1909. He left the laboratories to ally himself with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., where he remained until 1917 directing a portion of the company's high-voltage development work. Mr. Farnsworth, together with C. L. Fortescue, developed the use of the sphere spark gap as a standard of measurement for high voltage, and that method was adopted as an A.I.E.E. standard, replacing the needle-gap standard which had been used for many years. In 1919 he became assistant plant manager at the Evanston (Ill.) plant of the Steel & Tube Company of America and eighteen months later was transferred to the operating vice-president's office. In his new position at the Post Office Department Mr. Farnsworth will have general supervision over mechanical equipment and labor-saving devices in all branches of the service.

W. S. Hill, who has been electrical engineer for the Missouri Water & Power Company, with offices in Lebanon, Mo., has been selected as the general superintendent of the Grays Harbor Railway & Light Company at Aberdeen, Wash., and has departed for that city to enter upon his duties. Mr. Hill was formerly superintendent of the Springfield (Mo.) Gas & Electric Company and was connected with the Springfield utility for five years in that capacity and as manager of the commercial department. He went from Springfield to Stuttgart, Ark., where he was adopted as an A. I. E. E. standard, & Power Company for two years. He had been in Lebanon since last June.

Obituary

John Herget, treasurer of the Century Electric Company, St. Louis, died Nov. 14 of pneumonia. Mr. Herget had been connected with the company continuously since he joined it in 1904 as treasurer and had taken an active part in its growth. He was born in Hamburg, Germany, and was seventy-seven years of age.

J. C. Kirkpatrick, president of the National Pole & Tie Company, died at Escanaba, Mich., on Nov. 17 after an illness of four months. Mr. Kirkpatrick was born in Pittsburgh in 1863 and at the age of fourteen went to Escanaba with his father, who was then president of the Pittsburgh-Lake Superior Coal & Iron Company. It was while clearing timber lands for this company that Mr. Kirkpatrick first became associated with the pole industry, a business which he made his life work and in which he became widely known. He had been president of the National Pole & Tie Company for more than twenty-five years and at the time of his death was president of the Escanaba National Bank and the Escanaba Veneer Company. Mr. Kirkpatrick was a graduate of Lake Forest University and a member of the Union League and Chicago Athletic clubs, Chicago.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Linking Up Production and Consumption*

How Commodities Should Be Distributed Depends Upon the Nature of the Goods—Only Knowledge of Cost Can Lead to a Proper Determination of the Right Way

By O. D. Street

General Manager of Distribution, Western Electric Company

DISTRIBUTION is too often thought of, not only by the public at large but sometimes by the distributors and producers as well, as being a standardized method available for use in the process of transferring commodities from the factory to the consumer. As a matter of fact, there is no such thing as a standard plan by means of which commodities may be distributed most economically. Instead of there being one right way of marketing, there are many right ways. What the right way is for any producer can and must be determined by the producer—not by chance, not by rule of thumb, but as the result of a comprehensive, intelligent analysis of his own problems and products.

Such an analysis may not prove that it is wise for a given manufacturer to sell all his products direct to the consumer, nor will it of necessity prove that he should work through wholesalers in marketing all his lines. Instead, it may prove that, for a manufacturer who is not making just one thing but many things, the best plan would to be work directly with the consumer on one or more of his commodities, to go direct to retailers on others of his commodities, and to work exclusively through wholesalers on still another group of his commodities. If the analysis is made as carefully as present-day intelligence permits it to be made, the one best way for marketing each product of each manufacturer should be determined rightly nine times out of ten.

Four Controlling Factors

I have heard it said that about 80 per cent of our merchandise is sold by the makers to wholesalers, who in turn supply the retailers. A smaller percentage is sold direct by the makers to the retailers, and a still smaller percentage is sold direct by the makers to the consumers. All these methods are good and will continue to be employed. Which method to use is the problem each producer must decide for himself, and the problem will be solved first by those concerns which possess a type of management wherein is to be found the searching mind and wherein lies the will to find the correct answer.

O. D. STREET

Among the more controlling factors which must be considered by each producer who would get the right answer are these:

I. *The Nature of the Product.*—A large steam engine should be sold direct to the user, whereas hairpins, to be marketed economically, must be sold to wholesalers and possibly to large retailers.

II. *The Number of Customers Served.*—A few users, even though these may be widely scattered, can usually be served best by dealing directly with the factory, provided the money value in each sale is large. A great many customers scattered all over the country can, as a rule, be served best through jobbers, particularly if the value of each sale is relatively small.

III. *The Aptitude of the Management.*—Some executive families are experts at production but ought never to try distribution. The two require quite different commercial characteristics, and management should know its weaknesses as well as its strength.

IV. *The Financial Resources.*—Where capital is limited, it is often preferable to use all that is available in production rather than to skimp on plant, tools and other instruments of economical productions in order to carry the capital obligations involved in distribution.

At the present time too many concerns are selling their own products direct which would be better off if they worked with jobbers. There are also too many of another class which would be better off if they cut out the jobber and dealt direct with the retailers and consumers. By the same token, there are jobbers who would be better off if they would limit themselves to those items which they can handle better and more cheaply than the factory and not try to be all things to all men.

Cost Knowledge Needed

The reason why so many uneconomical methods of distributing are employed today is because so little is known, even by the most expert, of what it costs to sell and distribute merchandise. The monthly or annual costs of distributing all the products of a mill, or all the lines of a jobber, are known, but while these figures tell us how much money is made or lost on the entire business, they do not tell us how this money is made or lost. How antiquated is such a condition in production activities! Methods are available today, as a result of the development of the accounting art, which will show us almost exactly what it costs to manu-

*A paper read before the National Conference of Business Paper Editors, New York City, Oct. 11 and 12, 1922.

facture each item and each part in an item, but there is scarcely a concern in the country which knows what it costs to sell any one of its articles, unless it makes only one article, nor a concern which knows what it costs to sell to any one of its customers. A knowledge of what it costs us to sell each article we make and what it costs us to do business with each customer we serve is a prerequisite for determining whether we can distribute these articles and serve these customers cheaper and better than we can hire the work done for us. The facts must be determined by the producer —by each producer for himself—as he alone can get at the facts.

The very first thing, then, which is needed is the development of a cost-finding system which will give to each manufacturer a statement as to what it costs him to distribute each individual article he manufactures and what it costs him to serve each customer he sells to. Our shop cost systems have been highly developed, but little or nothing has as yet been done by accountants in any line of industry toward the development of a cost-finding system which will give to management even an approximate conception of what expense is involved in the sale and distribution of its individual commodities or of what it costs to sell to its individual customers.

I venture the prediction that a study of this sort will prove to many executives that many commodities which they have thought were highly profitable are, at least under the methods of distribution now employed, money losers rather than money makers. It may well be that even after that knowledge is secured management will still feel that it must continue to sell these articles because they are necessary to complete the line. However, the chances are that the method of selling these things will be changed, or else less money will be spent in attempting to sell them. Having an item to offer to one's trade in order to complete one's line is one thing; making that item a leader through ignorance of costs is another thing.

Business is far from being a pure science. It is a science, nevertheless, but the trouble with business men is that they have confined their scientific research largely to the field of production and have applied little or none of it to the problems of distribution. As an inevitable result, the superior skill which has been applied to production problems has caused production efficiency to get far ahead of distribution. The production skill which industry has developed has gone out and started competing factories until today we find ourselves confronted with a situation where the capacity to produce, and to produce skillfully, in most industries vastly exceeds the country's capacity to absorb—at least to absorb at the prices now quoted to the consumer.

OVERBUILT CAPACITY

The new competing factories turn out no more if as many units as did the original factories. Hence, as a rule, they do not produce at a lower cost; in fact, too often the tendency is to make production costs rise, since the new competition, rather than dispose of its products by creating new markets, usually cuts into the business held by the older factories. New producers, in order to market their products, often appoint a separate group of wholesalers and dealers, and these in turn cut into the business done by the old established distributors. At first competition—one maker with his distributors fighting to hold their business, another group fighting to get this business away from them—may and often does tend to reduce the price to the public. Soon, however, the heat of contest cools. Each organization decides to add the increased overhead cost incident to a lower volume of sales into its selling price, and thus it is passed along to the public. As time passes still more producers enter the field to share the new business and divide the old, and these in turn create new distributors whose competition tends still further to complicate the situation and add to the ultimate cost of the product.

Producing and production capacity, distribution and distribution facilities, have all multiplied during the last ten years, and now in spite of the reduced demand, all are trying to make a living, and nearly all are finding the going pretty slow. All cannot survive, and it is not to the interest of the public at large that all should survive.

This situation we are in would indicate that, for the good of the public at large, too much competition may well be as bad as too much monopoly; for it is a recognized fact that mass production, up to a certain point at least, is required in order to effect low production costs. Too much distribution—that is, too many middlemen—is just as bad, for a low volume of sales increases the distributing expenses per unit sold just the same as, at the factory, a small output increases the costs per unit produced, and in both of these instances there is the natural tendency to pass the increases on to the consumer.

There are too many commodities, which are being produced in too many factories and are being distributed by too many agencies, for the best interest of the public. I feel that many of these could be made and marketed more economically if some advantageous mergers were effected or some failures took place. This would by no means solve all our troubles nor eliminate all the waste in merchandising. However, it would help considerably, for production is not done at low cost unless the output is reasonably large, nor can a jobbing business be conducted cheaply unless the units of sale are relatively large and frequent. Retailing can be done cheaply if the units of sale are small, provided enough units are sold.

We must not forget that we are confronted with a changed economic condition, and management will do well if it falls in line, for that business which falls in line with an economic purpose bigger than itself has far and away the best chance of remaining permanently in business and of making steady profits.

Safe Automatic Control of Circuit Fusing

A Suggestion Concerning One Way to Prevent Overloading by Making Each Fuse Fit Only Its Own Block

BY J. M. FRIED
President Mississippi State Association Electrical Contractors and Dealers

ALTHOUGH various methods of preventing customers from using slugs in the place of fuses have been considered, the problem of controlling fire hazards due to overloading of circuits still exists. The mere fact that there does exist in any degree the practice of inserting various kinds of shorting devices to obtain service when the fuses blow indicates that this is the weak spot in the situation. It is not enough just to designate what size of fuse shall go with a given size of wire, because almost invariably when a 10-amp. fuse is lacking a 20-amp. fuse will be used if that is the only

one available, and when no fuse is at hand pennies are often inserted. Then the customer, without much serious thought to the risk he is assuming, wonders why trouble follows. The fault lies in the fact that the electrical industry does not build equipment so that an ordinary layman cannot possibly harm it by negligence and wrong fusing.

There is, however, one way that this difficulty can be solved. When manufacturers design a fuse and block of different dimensions for each size of wire, with the block so constructed as to prevent jumping across the fuse, then a step will be taken toward the settlement of this perplexing problem. This construction would make possible the use of only one size of fuse in any block, and this in return would be determined by the maximum current capacity of the wire itself. With such an installation there could be no overloading, since the fuse would blow before overheating the circuit, or before serious damage was done, thereby preventing fire. As the 660-watt rule now stands, there is always the possibility of overloading circuits, with all of the attendant fire hazards.

Under the system just recommended inspection would also be simplified because wire inspectors would not need to look up the connected load; for by glancing at the wire size and fuse block they would immediately know whether proper protection was furnished. It would also be an advantage to small towns having no inspection departments, because an installation as completed would be sure of passing inspection in so far as fusing is concerned. This would be especially true should this type of construction be required by the National Electrical Code, making the service-entrance and branch-circuit protection uniform throughout the country.

DISTRIBUTION NOT SERIOUS DRAWBACK

The problem of distributing this type of fuse block once it is manufactured is not so serious as first thought might suggest. As an example, the improvement in the installation of service entrances has been advancing steadily during the past years, but there has been nothing done toward branch-circuit protection or overfusing. Once the protection is known to be nearly 100 per cent foolproof, it will merely be a matter of time before this type of construction will be obligatory. Just as the industry now insists upon the inclosed safety switch, so it will accept a medium for improving the safety of its house wiring. The 660-watt rule is now receiving attention from the rules committee of the national association, and while the matter is up this problem should be solved to the best interests of all concerned and no temporary changes or half-way measures should be put into effect.

[Mr. Fried's suggestion has good precedent in the system of fuse control which is extensively in use in Germany and the amperage of which is indicated in both fuses and blocks by a color, so that even the illiterate may re-fuse a panel by selecting fuse plugs bearing color marks corresponding to the color on the block. At the same time, wrong fusing is prevented mechanically by a projecting pin on the plug which can be used only in proper block.—EDITORS.]

Survey of Business Conditions

High-Tension Equipment Market Showing Much Activity

Sales of high-tension equipment are still brisk in the Western territory. One company reports a steady volume of high-tension fuses up to 150,000 volts and lightning arresters up to 115,000 volts. Australian inquiries are also lively. Another company has sold 22,000-volt equipment to a utility in Indiana and a complete substation for Garfield Park, Chicago. Orders for two 44,000-volt, 1,500-kva. substations for the Middle West and one 66,000-volt, 3,000-kva. substation for a Western utility were received by another company.

The sales rate on poles has been active and most of this equipment has gone to central-station companies building line extensions. The freight-car shortage is seriously impeding rapid deliveries. Stocks are in good condition. Prices are firm and unchanged.

Demand for cross-arms parallels that for poles and the call is good. Prices remain the same with the 3-ft., 3¼x4¼-in. arm selling for $49.35 per 100 in lots of 1,000 f.o.b. Chicago.

Useful Market Data Being Issued by Boston Bank

The First National Bank of Boston is publishing a supplement to the booklet which it issued two years ago, entitled "Markets of the World." It is made up of a series of commercial maps and statistical data concerning the United States and Canada and embraces an unusual compilation of useful commercial information conveniently presented. While it contains an immense amount of information of interest to the student of commercial geography, it has been prepared especially for the use of the sales manager in determining the market possibilities of any given state, province or territory. There are detailed figures covering area and topography, population, education, minerals, timber, fisheries, water power, agriculture, industry, transportation, finances, principal cities and legal holidays.

Like the former series, it is in loose-leaf form and designed to be inserted in the original binder. The supplement is being sent to all holders of the first edition, and a limited number of copies are available for general distribution upon application to the service department of the First National Bank of Boston.

Control Hinders Radio Development in Czechoslovakia

Radio development in Czechoslovakia has not yet passed the stage of infancy, according to dispatches to the Department of Commerce from Consul Winans at Prague. He states, however, that the government has taken an active interest in radio development and in view of a more extensive and popular acceptance of this form of communication at home has sent a special commission of experts to study the progress made in other countries. Whether a sending station for radio messages will be established in Czecho-

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0295	$0.0285	$0.0273
Cold finished shafting, per lb.	0.0378	0.0373	0.0379
Brass rods, per lb.	0.171	0.1700	0.148
Solder (half and half), per lb.	0.23	0.228	0.20
Cotton waste, per lb.	0.11	0.11	0.112
Washers, cast iron (⅜-in.), per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.11	3.11	.....
Machine oil, per gal	0.36	0.36	.....
Belting, leather, medium, off list	40-5@50%	40-5@50%	.....
Machine bolts, up to 1-in. x 30-in., off list	55@60%	50@65-10%	50@60-10%

slovakia will depend upon the findings of this commission.

Even when finally introduced, however, the local industry cannot be expected to attain the state of development reached in the United States. It is stated by the Ministry of Posts and Telegraphs that all messages sent by radio will be subject to strict control by the government; not every person will be permitted to own a receiving or sending apparatus. High duty will be assessed on radio outfits and supplies of foreign make, and each radio set, whether of domestic or foreign manufacture, will have to be registered at the Ministry of Posts and Telegraphs. Many local factories are said to be interested in the future of radio telephony and to be awaiting a favorable moment for producing the necessary requirements of the industry.

Prevailing Conditions Affecting Cost and Volume

Coal Output Curtailed.—Preliminary estimates on coal production for the week ended Nov. 11, as revised by later reports reflecting the curtailed output because of election day and Armistice Day, put the total amount of coal raised at 11,939,000 net tons. Early returns on car loadings at mines for the week ended Nov. 18 indicate 13,200,000 net tons, comprising 11,100,000 tons of soft coal and 2,100,000 tons of anthracite.

Decrease in Number of Freight Cars Loaded.—Loading of revenue freight on American railroads during the week which ended Nov. 4 totaled 994,827 cars, according to reports received today by the American Railway Association from the carriers of the country. This was a decrease of 19,653 cars compared with the week before, due to the usual seasonal decline in traffic. But even in the face of this reduction this was the largest number of cars ever loaded during the first part of November in the history of the railroads of this country.

Bank Clearings Gain Appreciably.—The ratio of increase in bank clearings over last year's figures widened appreciably this week, an aggregate of $6,876,176,000 at twenty cities of the United States, as reported in *Dun's Review*, being 17.1 per cent in excess of the total of a year ago. Last week the gain over the clearings of the same period of 1921 was 9.5 per cent. Compared with the clearings of two years ago, a reduction of 10.9 per cent appears this week, but there was a decrease last week of 16.4 per cent.

Large Increase in Number of Failures.—Large increases are evident in the number of failures reported to R. G. Dun & Company from the East, South and West of the United States this week, while the Pacific section shows a marked decrease. As a result the total for this six-day week, 431, is much larger than the aggregate reported for the five-day week preceding, which was 387. This week's total is, however, more than 100 less than the 536 reported for the corresponding week last year. Both the number and the proportion of defaults with liabilities of more than $5,000 in each case have increased this week, there being 249 as against 214 last week, and the percentage being 57.7 as against 55.2 last week. A year ago similar insolvencies numbered 281 and were 52.4 per cent of the total for that week.

Decrease in Copper Smelting.—The Department of Commerce announces that reports made to the Bureau of the Census show a decrease in the activities of the establishments engaged primarily in the smelting and refining of copper during 1921, as compared with the year 1919. The total value of products reported amounted to $234,895,200 in 1921, and to $651,101,600 in 1919, a decrease of 63.9 per cent. Of the twenty-eight establishments reported for 1921, eight were located in Arizona; four each in Michigan and New Jersey; three in Montana; two in Tennessee, and one each in Maryland, Nevada, New York, Utah, Texas, Virginia and Washington.

British Electrical Exports Continue Decline

Figures for the September foreign trade in electrical goods of Great Britain show a total of £524,142 worth shipped during that month. This shows a decrease of £400,625, as compared with the previous year, bringing the nine-month decrease up to £5,247,233.

Electrical Slate Shipments 25 per Cent Higher

September shipments of electrical slate were 25 per cent higher than those in August, according to officials of the National Slate Association. Many large projects and buildings have reached the stage where electrical switchboards, panelboards, switch bases, etc., must be supplied.

Slate prices are holding firm. While fuel embargoes and car shortage materially delayed shipments during September and October, the acute situation is now somewhat relieved. Although considerable trouble in getting cars sufficient for shipments is still the rule, contractors and other slate users, appreciating the situation, are anticipating their slate needs and allowing more time between placement of their orders and the time the slate is required.

September slate sales keep up the pace set by August, running over $750,000, and are 2 per cent above 1920 and 4 per cent above 1921, according to sixty-one producing companies reporting to the National Slate Association. Thirty of the concerns reporting show that September is the first month when the cumulative year's total of shipments in 1922 has been 20 per cent above 1921 and 10 per cent above 1920.

The Metal Market

All Available Copper at 13.75 Cents Is Absorbed—Pronounced Premium Reported for Prompt Lead

Sales have been very satisfactory throughout the week, and all of the copper available at 13.75 cents delivered has been absorbed. Practically all producers are quoting 13.87½ cents. At least two producers are now quoting 14 cents, but are practically out of the market, and the quotation is purely a nominal one. Consumers report that business continues excellent, and many of them have booked more business into the new year than is usual at this period.

Foreign conditions are unsettled, and there seems little hope of a satisfactory foreign consumption in the immediate future.

Lead sales have been of about normal volume during the week, with regular customers of the larger producers able to book lead for December shipment at 7 cents. For prompt lead there is a pronounced premium, and small orders for November shipment have been booked at from 7.15 cents to 7.25 cents. This business represents only a small proportion of the total sales, however, the average price realized on all sales for the next two months being about 7.05 cents. October production was much better than that for the preceding month, and there is now an indication that increased prices are having an effect on increasing the supply of domestic lead in addition to furthering the entrance of Mexican lead into this country.

The zinc market is strong, and the present tendency is to continue the advance that has occurred during the week. Heavier tonnages were sold for export than during the previous seven days, but generally for forward delivery—in some cases as far ahead as next March. One or two producers with a small supply of prompt zinc have remained out of the market. The largest proportion of business was done for future delivery, and spot metal commands a premium of 5 to 10 points. The market has been difficult to quote for that reason. Small spot tonnages might have been sold each day at prices slightly higher than those we indicate.

The statistics of the American Zinc Institute for October show that, although production increased, consumption remains above it: Stock on hand Oct. 1, 1922, 18,806 tons; production, 39,940; shipments, 40,703; stock on hand Oct. 31, 18,043; reported sold for export during October, 1,038 tons.

NEW YORK METAL MARKET PRICES

	Nov. 16, 1922 Cents per Pound	Nov. 23, 1922 Cents per Pound
Copper		
Prime Lake	13.75	13.87½
Electrolytic	14.00	14.00
Casting	13.45	13.45
Lead, Am. S. & R. price	7.00	7.00
Antimony	6.50	6.50
Nickel, ingot	36.00	36.00
Zinc, spot	7.25	8.25
Tin, Straits	32.20	32.20
Aluminum, 98 to 99 per cent	21.50	21.50

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

HOLIDAY business is taking on more life in all sections of the United States, but some cities report shortages of certain stocks of heaters and ironers, a few manufacturers blaming poor transportation conditions for the lack of sufficient raw materials. Central-station activity in making line extensions is taking much high-tension equipment. Motors in all sizes are moving well. Radio jobbers report better sales, saying that much Christmas business is being carried through for parts and head sets. Vacuum cleaners are in much demand and washers are selling in better volume. Owing to the recent mild weather and some improvement in the coal situation, sales of heaters are not at all spectacular at the present, although sales are frequent.

New York

Lamp Sales Improving—Warm Weather Slowing Down Heater Sales—Vacuum Cleaners Active

Demand for all articles has not increased materially over conditions of one or two weeks ago, although there are many expressions throughout the trade that the holiday buying will tax the present local stocks to the limit. Placing of orders at this late period and inability to receive certain iron and steel products are said to be to blame for present conditions. Central-station companies are buying in goodly amounts for repairing and extending their lines in preparation for the winter months.

Lamps.—Sales are improving each week, the commercial-purpose lamps selling in best volume. Much replacement business is reported.

Radiant Heaters. — The warmer weather during the past two weeks is said to have had much effect in slowing down sales. Improved conditions in the fuel situation are causing less anxiety for those who depend on coal.

Vacuum Cleaners. — Vigorous sales campaigns helped by advertising campaigns in the consumers' magazines are resulting in a good volume of sales. Much competition in the field has reduced profits to a minimum.

Chicago

Wire Demand Slackened—Car Shortage Hinders Conduit Shipments—Heating Appliances Active

Business in the electrical trade is still continuing to move at a steady rate. Demand for wiring material has become slackened just a little, but the main volume remains good. Freight car shortage is continuing to hinder shipments of conduit. Manufacturers of high-tension equipment are unanimous in reporting very brisk business. The call for poles is good and nearly all construction is for new power lines. Heating appliances are selling well and stocks are ample to supply the trade.

Conduit. — Jobbers report a slight easing in the scarcity of conduit since shipments from manufacturers have improved silghtly. The ½-in. black pipe in lots of 5,000 ft. or more sells between $57 and $60 per 1,000 ft. An active demand, however, is keeping stocks rather low.

Wire.—Action on wire is still steady, but with a slight tendency toward a decreasing demand. The rubber-covered No. 14 is quoted at $6.40 per 1,000 ft. in 5,000-ft. lots. Stocks are normal.

Flexible Armored Conductor.—Movement has fallen off, but the main volume is firm. No. 14 two-wire, single-strip conductor is available for $47 per 1,000 ft. in lots of 5,000 ft. Stocks are ample.

Heating Appliances.—The call for open air heaters is growing, colder weather creating more interest, Stocks are in good shape.

Boston

Cross-Arm Sales Showing Improvement—Portable Lamps Active—Lighting Set Business Brisk

Business continues at about the same level as last week. Deliveries on products manufactured outside New England are impaired by embargoes, but current stocks are meeting present demands reasonably well. Prices are firm. Improvement in general manufacturing circles is well sustained, and retail trade is active. Central-station outputs are growing by leaps and bounds, and additions to plants are being considered and installed to meet anticipated heavier requirements in the coming year.

Cross-Arms. — Sales are showing some improvement, although business is not in striking volume.

Pole-Line Hardware.—Recent buying has been good with deliveries out of stock satisfying immediate needs. Prices are firm.

Lamps.—Portable lamps are selling with marked activity, one dealer recently disposing of 1,400 to a single customer. Stocks are varied and attractive.

Wire.—Slow-burning weatherproof is moving in fair volume on an 18-cent base. Rubber-covered No. 14 is active at $6.25 per 1,000 ft. in 5,000-ft. lots.

Starting and Lighting Sets.—Business is brisk, one manufacturer having on hand three million dollars' worth of unfilled orders. The demand for magnetos is also very active.

Vacuum Cleaners. — Eight central-station retail departments sold 153 cleaners of a single make in six weeks. Business is responding to vigorous sales efforts, and competition is very active. Freight embargoes are giving trouble on some outside New England factory shipments.

Radiant Heaters. — Owing to mild weather and some improvement in the fuel situation, the sale of heaters is not at all spectacular at present, although sales are frequent. Stocks are in good shape, from outward appearances.

Wiring Devices.—Large quantities of sockets, switches, etc., are being absorbed by new building construction in Boston and the suburban territory. New England factory shipments are coming through well. Prices are firm, with minor readjustments in various fittings.

Atlanta

Volume of Lamp Sales Greater—Heating Pads More Popular—Insulator Stocks Satisfactory

Business continues to improve throughout the section, excellent weather conditions permitting builders to push construction and farmers to harvest crops. This has virtually served to eliminate non-employment and speed up material purchases. In the electrical business certain materials are short, particularly conduit.

Sales campaigns being made by manufacturers, dealers and central stations are serving to stimulate the movement in appliance lines. Considerable heavy construction by industries is being talked of, though as yet no definite plans have been announced, the tendency being to wait until after the first of the year.

Lamps.—The fall movement is in full swing with stocks in good shape and deliveries prompt. The volume of sales is somewhat greater than it was last fall. The 100-watt and 200-watt type C lamps are the best sellers.

Flashlights.—Sales of cases are only fair, but a reasonably satisfactory volume of batteries and lamps is reported, though not up to the seasonal volume. Stocks are adequate and deliveries good.

Heating Pads.—This specialty shows an increase in popularity and jobbers report the movement more active than for some time. Sufficient stocks to meet the holiday demand are on hand.

Panelboards.—An excellent volume of orders is reported in this line in all variety of sizes. Factory shipments are very good.

Insulators.—The 2,300-volt porcelain type is quite active, with the glass telephone types continuing their steady movement. High-tension insulator sales

are fair to good. Stocks of the 2,300-volt type are fair with shipments satisfactory.

Air Heaters.—Owing to mild weather, jobbers have had little success in disposing of this specialty to date. Excellent stocks are on hand in anticipation of a brisk movement when cold weather arrives.

Wire.—Sales of both weatherproof and rubber-covered are good, with low stocks reported on No. 12 and No. 14 rubber-covered. A price advance of 5 per cent on rubber-covered is announced this week.

Cleveland

Jobbers Report Fair Movement in All Sizes of Motors—Strong Fixture Market

That a favorable holiday season for appliances is anticipated is evident in dealers' orders.

Motors.—Jobbers report a fair movement in all sizes. Stocks are good and deliveries prompt.

Washers.—Sales have been in good volume. Ironer sales have fallen off slightly but not sufficiently to be alarming. Competition is keen.

Heaters.—Dealers report a renewal of activity in the smaller type and attribute it to cooler weather. Stocks, recovered from the last rush, are sufficient to meet the demand easily.

Fixtures.—Although the end of the building season is in sight, fixtures continue to be in demand. Lamps are accordingly holding up well, and lamp-cord sales have experienced some acceleration.

St. Louis

Power-Generating Equipment Sales Good—Prices Show Upward Trend—Conduit Active

Sales of power-generating equipment have been especially good this week, one of the railroads being the buyer of about $100,000 of equipment. Inquiries on such items are quite attractive, and the next few months should bring in sizable orders. Prices have shown upward tendencies, increases of about 10 per cent being made in sockets and conduit and smaller increases in wire and flexible armored conductor. Demand for supplies is in general active, and sales of merchandising supplies are especially good.

Conduit.—Prices continue upward with low stocks and strong demand.

Wire.—No. 14 rubber-covered is higher by about 5 cents per 1,000 ft., selling for $6.25 per 1,000 ft. in 5,000-ft. lots. Other prices are unchanged. Demand is steady and stocks are in good condition.

Flexible Armored Conductor.—An increase from $4.80 to $5.00 per 100 ft. in 250-ft. lots is found in No. 14 two-wire conductor. Stocks have a tendency to be low.

Lamp Cord.—Better business is reported. Stocks are ample and prices stable. Cotton cord, twisted, in 1,000-ft. lots, is priced as follows per 1,000 ft: No. 18, $11.50; No. 16, $15.23; No. 14, $23.02.

Portland-Seattle

Lamp Business Greater Than a Year Ago—Less Activity in Farm Lighting

Lumber production shows a slight decrease but is still above normal. Electrical jobbers report business conditions good. They are much better than they were a year ago and probably approach pre-war conditions. Prices continue to stiffen in copper and steel products. The volume of lamp business is in excess of a year ago, although the value is not materially changed because of a decrease in the price of lamps. Decreased activity is reported in regard to farm-lighting plants because of low prices for crops and inability to move them in some sections. Deliveries are gradually improving and stocks are in better shape. Active buying of hollow ware, heating devices, flashlights and other holiday stocks for delivery after the first of the month is reported throughout the district.

Porcelain.—Demand for knobs, tubes and cleats continues active. Prices are practically unchanged and ample stocks are maintained at all times.

Salt Lake City

Interest Centering on Holiday Trade—Reduction on High-Grade Radio Head Sets

Interest in electrical circles is centering on the holiday trade. Dealers are ordering better than for several years, and as a result jobbers are hard put to it in some cases to meet orders. Manufacturers are unable to fill all orders for hollow ware and in some instances they have resorted to cancellation.

The dearth of business during the past three years has resulted in a steady depletion of stocks and no one seems to be ready for the sudden activity. There is a persistent and quite general upward trend in prices on electrical merchandise, the result being a quickened demand. Railroad schedules are reported improved and metal prices are firmer.

Radio.—Interest in radio still lags. A 25 per cent reduction on high-grade head sets was announced this week by a local manufacturer. With the steady increase of broadcasting stations and shortened distances, the cheaper receiving apparatus is acquiring a competitive advantage over the high-priced apparatus.

Washers.—Several aggressive washer and vacuum-cleaner campaigns are now in progress. The response, however, is not entirely gratifying. Stocks are good.

Denver

Stocks of Ranges Are Small But Ample—Splendid Prospects for Christmas Business

Increased business in manufacturing and mechanical industries and a large amount of new construction work have benefited electrical industry. Severe storms have temporarily embarrassed nearly every line of business. Transportation tie-ups are now untangled and building activities continue as before.

Ranges.—Some interest is being manifested outside of the city, though local sales are negligible. The cost of installations in comparison with that of gas ranges is believed to be the principal deterrent. Small but ample stocks exist in local territory.

Meters.—Central stations are well supplied. No outside demand has developed. Prices stable with supply satisfactory.

Radio.—Interest is greater in radio sets and parts. Local jobbers are stabilizing activity and standardizing on supply. Splendid prospects are reported for christmas business.

Toasters.—Standard lines in demand with one type reduced on local market to $5.95. Jobbers' stocks are ample while retailers are buying in lesser amounts.

Safety Panels.—Several large residence installations have stimulated local interest in this line. Standard equipment is conservatively stocked by manufacturers subject to jobbers' calls. Special jobs are being turned out locally on a few days' notice. Prices are steady.

San Francisco

Electrical Collections Improved—Appliance Stocks Sufficient—October Washer Sales Set New Record

Electrical men are jubilant over the recent decisive defeat of the power and water act, declaring the result of the vote to be public confirmation and appreciation of their endeavors to provide efficient and economical electrical service. The outlook for the future is decidedly optimistic. Resulting construction will maintain a high level for another year at least. Labor conditions are much improved and there is little lack of employment. Collections have again improved.

Appliances.—The California Electrical Co-operative Campaign has prepared some excellent display material for holidays. The tendency is not to rush this business this season. Some nice orders from dealers are reported, and improved appliances and combination devices are featured. Fairly large stocks are carried over.

Washers.—October business has set new records for the past twelve months. In some cases dealers report rather poor November sales. One crew of thirty men sold 120 machines last month assisted by lists of "prospects" secured at fairs.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Western Electric Company's Sales Were $170,000,000

President Charles G. DuBois of the Western Electric Company announces sales for the first ten months of 1922 amounting to $170,000,000, indicating a volume of business for the year slightly in excess of the sales in 1920, which was the largest year in the history of the company.

The orders received during the first ten months of the year have amounted to $152,000,000, or approximately $24,000,000 more than for the same period in 1921. On Oct. 31, 1922, the company had on its payrolls the largest number of employees in its history, 50,177, representing an increase of nearly 5,000 as compared with the first of the year.

Association Awards $500 for Electric Truck Slogan

Selected from more than 6,000 suggestions in the slogan contest held by the Electric Motor Truck Association, that submitted by J. H. Anderson, 111 Broadway, has been adjudged the winner of the five-hundred-dollar prize. The winning slogan consisted of seven words, "Use Electric Trucks—Why? Ask All Owners."

C. W. Curtiss and Carl T. Mason Organize Metropolitan Radio

C. W. Curtiss, Newark, N. J., formerly general manager of the Splitdorf Electrical Company, 98 Warren Street, and Carl T. Mason, previously chief engineer of the same company, have organized the Metropolitan Radio Corporation to operate a plant at 67 Goble Street for the manufacture of receiving sets, head telephones, jacks and other radio apparatus. Mr. Curtiss is president and Mr. Mason is chief engineer of the company.

Apex Firm Points Out Saving Feature of Cleaners

In comparing costs between keeping house with and without an electric suction sweeper, the Apex Electrical Distributing Company, Cleveland, has issued information to its sales force as follows:

Cleaning house with a broom and dust cloth requires ten hours per week, the company estimates. "Every housewife should value her time at 30 cents an hour. Ten hours a week at 30 cents an hour for fifty-two weeks amounts to $156."

The company points out that ten hours' work by hand is done in four hours with an electric vacuum cleaner. The cost of labor for operating a cleaner amounts to $62.40 for a year. The cost of energy is placed at $3.33, and the cost of the cleaner, prorated over ten years, amounts to $6.88. The company estimates the saving at $83.39.

Lewis Opens Sample Displays at Worcester and Salem, Mass.

To facilitate exhibiting wiring supplies, fixtures and other material to contractor-dealers and other prospective customers, the Lewis Electrical Supply Company, Boston, has recently established local sample displays at Salem and Worcester, Mass. These displays are respectively in charge of T. A. Russell and Lawrence W. Smith, resident representatives of the house in the Salem and Worcester districts.

Arrangements have been made for the permanent occupancy of quarters at the Essex House, Salem, and the Hotel Warren, Worcester, for this purpose. No warehousing is done at these quarters, but the maintenance of representative diversified local stocks of supplies greatly facilitates the examination of material by prospective purchasers apart from their usual home office surroundings and distractions and also broadens the local conception of the range of service rendered by the modern electrical supply jobber. In some cases local newspaper advertising is keyed in with the inauguration and maintenance of the displays.

Underwriters' Laboratories to Move to Larger Quarters

The New York City offices of the Underwriters' Laboratories will be moved Dec. 1 from 25 City Hall Place, where they have been for the past five years, to new quarters in the Underwriters' Laboratories Building at 109-111 Leonard Street. They will occupy the entire two upper floors, and additional space has been provided for still further expansion.

This step has been made necessary by the rapidly increasing demands for the Laboratories' service, and also by the fact that casualty and burglary protection devices have recently been added to the list taken care of at the New York branch, until recently occupied solely with matters electrical.

At this new location will be continued the work of the electrical testing laboratories and the conducting of inspections at factories and label service in the metropolitan district, which includes New York, New Jersey and southern Connecticut. The whole will be, as formerly, under the general direction of Dana Pierce, vice-president.

Says Small Minority Plans to Upset Wagner Reorganization

Suit for an injunction to prevent the reorganization of the Wagner Electric Company under the laws of Delaware and asking that a receiver be named for the company was filed last week by owners of 1,600 shares of preferred stock. The petitioners alleged that the preferred stock of the company would be rendered valueless by the reorganization at this time.

The suit, which was filed in the state courts, also demands the removal of the company's officers. It was filed by the estates of Richard C. Kerns, former Ambassador to Austria; Jeane M. Leahy and John J. Raleigh.

The company has outstanding $1,500,000 of preferred stock of $100 par value and 80,000 shares of common stock of no par value.

President W. A. Layman authorized the following statement: "The suit filed in the Circuit Court at St. Louis, Nov. 18, asking for a receiver of the company and an injunction against the transfer of the company's assets to the new Wagner Electric Corporation, is an action by a very small minority interest in the old Wagner company, owning about 1½ per cent of the stock of that company to upset the financial reorganization of the Wagner business. The situation in substance is that the Wagner plan of financial reorganization was accomplished Aug. 11, 1922, when the properties of the old Wagner Electric Manufacturing Company, a Missouri corporation, was transferred to the Wagner Electric Corporation, a Delaware company, the latter becoming the operating company, assuming all assets and liabilities of the Missouri company. The transfer was made by authority of a special meeting of stockholders of the Missouri company held Aug. 4 for this particular purpose. At this special meeting 92 per cent of the total shares outstanding were represented and this 92 per cent, with the exception of 101 shares, voted in favor of the entire reorganization plan and authorized the directors and officers to place it in effect. The owners of the shares bringing this suit, in all about 800 shares, were not represented at the meeting and this stock was not voted either for or against the reorganization plan. The officers and directors are assured by the attorneys of the company that every step taken in the process of reorganization has complied with the law, that all steps taken have been approved by a larger percentage of stock than the law requires, and that there need be no apprehensions of the outcome of the litigation. Through the reorganization plan, the bank obligations of the old company were entirely paid off and the new Wagner corporation's total current obligations were for current merchandise requirements only, which obligations are substantially less than the company's cash in bank."

Stockholders will vote on ratification Dec. 29.

Gibb Instrument Company Will Locate in Bay City, Mich.

The Gibb Instrument Company, Detroit, manufacturer of electric welding equipment, announces the removal of its plant and offices to Bay City, Mich., effective Dec. 1. The purpose of this move is to provide greatly increased manufacturing facilities to take care of a rapidly increasing business. For the past two years this company has concentrated on the development of automatic and semi-automatic arc, spot and seam welders.

Monitor Controller Company Establishes Southern Branch

The Monitor Controller Company, manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus, has recently established in the South a branch sales office at Birmingham, Ala. The main office and works of the company are at Baltimore. Other branch offices are established in a number of the larger cities.

Goggin and Ripley Form Personal Service Corporation

Announcement is made that Victor T. Goggin and James H. Ripley, formerly contracting engineers with Dwight P. Robinson & Company, Inc., have formed a partnership under the name of Goggin & Ripley, Inc., with headquarters at 350 Madison Avenue, New York City, as a personal service corporation to assist business executives, bankers and engineers in conceiving, financing and developing construction projects.

United Electric Company Is Holding Sales Contest

The United Electric Company, Canton, Ohio, manufacturer of cleaners, announces that it is presenting as a gift to each of the forty salesmen selling individually most cleaners between Nov. 6 and Dec. 16 one of its cleaners. The "Salesmen's Christmas Tree," as the company has named the present contest, has attracted more entries than any other sales contest put on by this company, it is stated.

Radio Shop of Sunnyvale, Cal., Establishes St. Louis Factory

The Radio Shop of Sunnyvale, Cal., announces the establishment of a branch factory at St. Louis. This company has been engaged in the manufacture of Armstrong regenerative circuit radio equipment on the Pacific Coast, and the increase in business has made it necessary to establish another factory in the Middle West.

A. B. Dorman, manager of the company for the Eastern part of the United States, has established his office in St. Louis. He reports that the Echo Radio Corporation has been organized to take over the national distribution of the products of his company. Jobbers are being selected to handle the line. The offices of the Echo Radio Corporation are at 315 International Life Building, St. Louis.

Electrical Products Firm Adds Frank Foley to Sales Force

The Electrical Products Company, 17 East Forty-second Street, New York City, announces that it has recently added Frank Foley to its sales force. Mr. Foley was formerly associated with the Western Electric Company and the H. C. Roberts Electric Company. He will sell the National Metal Molding Company's products under the direction of the Electrical Products Company.

The Walker Vehicle Company, Chicago, manufacturer of electric trucks, has arranged for the construction of a three-story reinforced-concrete service station building to be erected on a plot, 100 ft. x 115 ft., at the southwest corner of Ely Avenue and Thirteenth Street, Long Island City.

The Keifer Electrical Supply Company, Peoria, Ill., which was recently incorporated with a capital of $30,000 to manufacture electrical equipment and supplies, announces that it does not purpose to do any manufacturing, at least for the time being. It will act as a distributor.

The Westinghouse Electric & Manufacturing Company has received orders for $600,000 worth of electrical locomotives, five for the New York, New Haven & Hartford Railroad and four for the Norfolk & Western Railroad. There are now 105 Westinghouse locomotives on the New Haven and twelve on the Norfolk & Western.

The Laundryette Manufacturing Company, Cleveland, announces that its factory produced more washing machines in the month of October than in any month in the company's history.

The Bussmann Manufacturing Company, manufacturer of fuses, St. Louis, has removed its New York City branch office and storeroom to 27 Warren Street. The company's other New York establishment is at 23 Murray Street.

The Dominion Asbestos & Rubber Corporation has removed its offices from 154 Nassau Street to 1780 Broadway, New York City. This company has recently added to its line the Dominion brake block for use on heavy hoisting apparatus.

Frederick Franz, who for the past four years has been chief engineer of the Terminal Engineering Company, manufacturer of trucks for both indoor and outdoor usages in shipping and industrial plants, has established an engineering office at 27 Warren Street, New York City, for the purpose of solving special problems of engineering relating to labor-saving machinery.

The Pioneer Storage Battery Company, Philadelphia, has taken title to the three-story building at 244 North Fifteenth Street for a local plant.

The Electric Cord Adjuster Corporation, 103 East 125th Street, New York City, which was recently incorporated to manufacture electrical equipment, is in the market for black steel-spring wire and tubing. A. F. Brown is manager of the company.

The Harbison-Walker Refractories Company, Oliver Building, Pittsburgh, has arranged a program for extensions and improvements at its Blandburg (Pa.) plants to cost approximately $1,000,000.

The Harrisburg Manufacturing & Boiler Company, Nineteenth and Naudain Streets, Harrisburg, Pa., has acquired property at Bolton and Blackwood Streets for expansion.

The Kokomo Steel & Wire Company, Kokomo, Ind., has started the construction of a new building, 90 ft. x 425 ft., to house its galvanizing department, estimated to cost $50,000.

The Robertson-Cataract Electric Company, Buffalo, N. Y., has disposed of a preferred stock issue of $180,000, a portion of the proceeds to be used for general operations, in connection with its subsidiary organization the Robertson Electric Construction Company, manufacturer of switchboards and other electrical equipment.

The Arey & Blount Electric Company, Worcester, Mass., recently organized by William H. Blount, formerly superintendent of Sleeper & Hartley, Inc., will operate a local plant for the manufacture of electric flashing devices and kindred specialties.

The Englert Manufacturing Company, Pittsburgh, manufacturer of batteries, etc., has awarded a contract to the Duquesne Construction Company, Bessemer Building, for the construction of a new plant on property acquired at Jane and South Twenty-fifth Streets.

The Acorn Insulated Wire Company, Brooklyn, N. Y., has disposed of its water-front property on the Gowanus Canal, Ninth Street, to the T. & T. Coal Company, for a consideration of about $125,000.

The Babcock & Wilcox Company, 85 Liberty Street, New York, manufacturer of water-tube boilers, is perfecting plans for an increase in capital from $15,000,000 to $25,000,000, a portion of the proceeds to be used for general expansion.

The Lexington Battery Company, Lexington, Ky., manufacturer of batteries, has plans in progress for the rebuilding of the portion of its plant recently destroyed by fire with loss of about $75,000. The new structure is estimated to cost close to a like amount.

The Phillips Insulated Wire Company, Pawtucket, R. I., is erecting a twenty-five-thousand-dollar addition to its power plant. The new section is to be one story high and approximately 65 ft. x 30 ft.

Foreign Trade Notes

PROPOSED ELECTRIC POWER SCHEME FOR BURMAH, INDIA.—A proposal to develop water power to generate electricity in Burmah, India, is reported to be under consideration. It is proposed to divert the waters of the Yunzalin River to generate electricity to be transmitted to Rangoon.

PROPOSED HYDRO-ELECTRIC DEVELOPMENTS ON THE RHINE RIVER. —A company has been organized by the presidents of twenty chambers of commerce for eastern France, senators and financiers for the purpose of studying the proposal to utilize the waters of the Rhine River for hydro-electric developments and irrigation projects. The company is known as the Société Régionale d'Etudes du Rhin, and is capitalized at 500,000 francs. Besides the twenty chambers of commerce, the Société des Forces Motrices du Rhin, the Port of Strasbourg and the eastern economic regions are interested in the project. The headquarters of the company are in Nancy.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Ireland (No. 4,336) for electrical goods and equipment of every kind, household and building hardware, etc.

Catalogs and price lists are desired in Czechoslovakia (No. 4,354) for all sorts of radio-telegraphic apparatus and precision instruments for radio laboratories, such as ammeters and voltmeters.

Purchase is desired in Canada (No. 4,355) of plant for the development of power facilities, or equipment for the extension of existing electric light plant through the use of crude-oil engines or water power. Quotations, literature and catalogs are requested.

Purchase is desired in Chile (No. 4,365) of electric light bulbs, rubber tires and all accessories for low-priced automobiles.

An agency is desired in Sweden (No. 4,371) for electrical goods of all kinds, labor-saving machinery, machine tools, novelties in the engineering line, etc.

An agency is desired in Spain (No. 4,372) for electrical apparatus of all kinds and machinery in general.

An agency and purchase is desired in France (No. 4,388) of household appliances, particularly electrical.

An agency is desired in Belgium (No. 4,389) for wireless apparatus and electrical appliances and implements used on ships.

New Apparatus and Publications

AUTOMOBILE AMMETER. — An automobile ammeter that has no electrical coils or connections, known as the type "BT" ammeter, has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This instrument can also be adapted for use on motorboats, aërial craft, farm-lighting plants, radio plants and for charging batteries.

THERMOSTATIC SWITCH.—The Minneapolis Heat Regulator Company, Minneapolis, Minn., has recently developed the "Minneapolis" thermostatic relay switch for the thermostatic control of motors, electric heating units and other electrical circuits.

FLASHLIGHT.—A flashlight without a battery has recently been placed on the market by the Powerlite Company, Cleveland.

POTENTIOMETER.—The "Amsco" potentiometer for plate voltage control on receiving tubes has been developed by the Advance Metal Stamping Company, 17 Thompson Street, New York City.

AMPLIFYING TUBE CONTROL. — The Klosner Improved Apparatus Company, 2024 Boston Road, New York City, has placed on the market a tube rheostat known as the "Amplitrol."

THERAPEUTIC LAMP.—A new heat and light infuser, "Stein-O-Lite," has been developed by the Frank S. Betz Company, 6 West Forty-eighth Street, New York City.

PORTABLE BAND SAW.—A new electrically driven band saw for use in carpenter and pattern shops and woodworking plants has been placed on the market by J. D. Wallace & Company, 1,401 West Jackson Boulevard, Chicago.

ELECTRIC BUTTER CHURN. — The Superior Churn & Manufacturing Company has placed on the market an electrically driven butter churn.

BATTERY CHARGER.—The Automatic Electrical Devices Company, 134 West Third Street, Cincinnati, has recently brought out the new "radio home charger de luxe" for charging "A" and "B" batteries.

VERNIER RHEOSTAT. — A drum-type rheostat, known as model "223," designed for one-hole panel mounting, has been placed on the market by the Precise Manufacturing Corporation, 254 Mill Street, Rochester, N. Y.

CABINET RECEIVING SET.—The Crosley Manufacturing Company, Cincinnati, has placed on the market a new cabinet radio receiver, known as "XX."

CONDENSER TUBES.—"Chase Condenser Tubes" is the title of a thirty-two-page booklet published by the Chase Metal Works, Waterbury, Conn., which describes and illustrates the manufacture of the Chase condenser tubes.

PORTABLE LAMP.—The Bussman Manufacturing Company, 3819 North Twenty-third Street, St. Louis, has recently developed a new portable lamp, known as the "Clamp-O-Set" lamp.

New Incorporations

THE TRI-STATE ELECTRIC COMPANY, Ashland, Ky., has been incorporated by Allen Jansen, E. L. Hillard and Hays Nelson.

THE NANSEMOND PUBLIC UTILITIES CORPORATION, Norfolk, Va., has been incorporated with a capital stock of $25,000 to distribute electricity in Nansemond County for power purposes. E. L. Myers is president and William C. Hess secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GLOUCESTER, MASS.—The Gloucester Electric Company has been granted permission to issue $102,620, in capital stock, part of the proceeds to be used for extensions and improvements.

BETHLEHEM, CONN.—Steps have been taken by local business men to have the Litchfield (Conn.) Electric Light & Power Company extend its service to Bethlehem Center.

NEW HAVEN, CONN.—The Connecticut Company contemplates the erection of an addition to its power plant on Grand Avenue, to cost about $150,000.

Middle Atlantic States

BLASDELL, N. Y.—An electric pumping plant will be installed in connection with proposed improvements to the sewerage system, to cost about $200,000.

BUFFALO, N. Y.—The Buffalo Steel Car Company, East Walden Avenue, is planning to erect a new power house, 25 ft. x 100 ft.

HORNELL, N. Y.—E. L. Phillips & Company, 50 Church Street, New York, are negotiating for the purchase of the property of the Hornell Electric Company. Extensions and improvements will be made.

JAMAICA, N. Y.—Electric power equipment will be installed in the printing plant to be erected by the Edward Langer Printing Compay, Inc., to cost about $300,000.

LYNBROOK, N. Y.—A movement to establish a municipal electric light and water plant has been started by the Village Board.

NEW YORK, N. Y. — Electric power equipment, ice and refrigerating machinery will be installed in the three-story plant to be erected at 9-19 West 141st Street by the Reid Ice Cream Company, 524 Waverley Avenue, to cost about $250,000.

NORTH TONAWANDA, N. Y.—The Board of Aldermen is negotiating with the Tonawanda Power Company for the installation of a new lighting system in the business district.

OLEAN, N. Y.—The Niagara, Lockport & Ontario Power Company plans to extend its transmission line from Springville to Olean via Wellsville, and also to erect transmission lines to Elmira and Binghamton, where local power plants will be acquired. Power plants have recently been purchased at Jamestown, Salamanca and Bradford, N. Y., and Meadville, Pa., which will be used for emergency service.

HAMBURG, N. J.—The Lime & Stone Products Company will equip its plant for electrical operation. Electricity will be furnished by the New Jersey Power & Light Company.

MAPLE SHADE, N. J.—Electric pumping equipment will be installed by the Maple Shade Water Company in connection with proposed extensions and improvements, to cost about $50,000.

NEWARK, N. J.—The Public Service Electric Company has received permission to issue $2,250,000 in capital stock, the proceeds to be used for extensions and improvements as follows: Installation of condensers, transformers, etc., at the Hoboken station to cost $107,600; extensions to power plant at Burlington, $270,000; motor-generator, condensers, etc., at the Paterson power plant, $106,000; transmission line, from Passaic to Athenia, $20,000; equipment for the Camden plant, $54,700 and for electric pumping machinery at Perth Amboy, $25,600.

HARRISBURG, PA. — Plans are being prepared for the installation of an improved lighting system on Walnut, South Cameron and East Market Streets and other thoroughfares in the business section.

LEWISTON, PA.—The Penn Central Light & Power Company, Altoona, is planning to erect a substation at the local "viscose" plant.

PITTSBURGH, PA. — The Patterson Township Light Company, recently organized, plans to install a transmission and distributing system in Patterson Township. C. J. Braun, Jr., 435 Sixth Avenue, is treasurer.

SCRANTON, PA.—The construction of a new power house, to cost about $60,000, is under consideration by the Scranton Lace Company.

SLATINGTON, PA. — Electric power equipment will be installed in the proposed printing plant to be erected by John A. Brush and associates, to cost about $200,000.

TITUSVILLE, PA.—The erection of a high-tension transmission line from Titusville to Hydetown and Pleasantville, and additional lines in and around the Titusville factory district, is under consideration by the Titusville Light & Power Company.

WATSONTOWN, PA.—The Watsontown Sash & Door Company plans to build a steam-driven electric power plant to cost about $300,000. A franchise has been asked for local commercial service.

BALTIMORE, MD.—The American Oil Company, American Building, will install electric power equipment in its proposed new plant at Curtis Bay to cost about $500,000.

RIDGEWAY, W. VA.—A power plant will be erected at the proposed new automobile manufacturing plant to be erected in Ridgeway, to cost about $1,500,000. A company is being organized to carry out the project. Pihl & Miller, Wabash Building, Pittsburgh, Pa., contractors, are in charge.

SOUTH CHARLESTON, W. VA.—The Evans Lead Company, a subsidiary of the Ohio Alloy Company, Fostoria, Ohio, plans to construct a power house at its proposed local plant, to cost about $150,000.

WHEELING, W. VA.—Bids will be received by the city of Wheeling until Dec. 12 for three low-service and three high-service motor-driven centrifugal pumping engine units of 10,000,000, 15,000,000 and 20,000,000 gal. capacity. C. H. Dowler is city manager.

FRONT ROYAL, VA.—The Warren Power Company has acquired a hydro-electric power plant on Morgan's Ford. Extensions and improvements will be made and the station tied in with the company's system.

NORFOLK, VA.—Henry B. Reardon, Jr., consulting engineer, Norfolk, has been engaged by W. G. Maupin to equip his steam-driven ice plant for electrical operation. Synchronous motors will be installed and a 500-kw. (approximately) 11,000/2,200-volt substation erected. Transformers, switchboard and other equipment will be required. Motors have been purchased.

SCOTTSVILLE, VA.—Preliminary plans are being prepared by the Big Bend Power Company for six hydro-electric plants on the James River with an initial power station to develop 30,000 hp. and a transmission system. The cost of the work is estimated at $3,000,000. The Ambler Engineering Company, Richmond, is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Dec. 12 for twenty portable electric drills and nine electric grinders (Schedule 295); also for a quantity of dry cells for Eastern and Western yards (Schedule 300).

North Central States

DETROIT, MICH.—The Stroh Products Company, 909 East Elizabeth Street, will build an addition to its power house.

EATON RAPIDS, MICH.—The Consumers' Power Company, Jackson, is planning to build a new plant in Eaton Rapids.

STANTON, MICH.—The municipal electric light plant has been purchased by the Stockbridge (Mich.) Light & Power Company. A new Diesel engine will be used to furnish power until water power from Langston is available. The company will overhaul the transmission lines and complete a new street-lighting system.

WHITEHILL, MICH. — The Commonwealth Light & Power Company, 141 Broadway, New York City, has purchased the property of the White River Power & Light Company, Whitehall. This purchase will make hydro-electric power available for Ludington, which is served by the Commonwealth company.

BAIRDSTOWN, OHIO.—The town Council has granted the North Baltimore (Ohio) Service Company a franchise to extend its light and power service to Bairdstown.

CINCINNATI, OHIO.—A 10,000-kw. substation will be erected by the Union Gas & Electric Company on Mitchell Avenue between Millcreek and the Baltimore Railroad. This station will carry the load of the Winto Place district and will eventually be of much larger capacity. The cost of the building will be about $40,000. C. W. De Forrest is chief engineer of the company.

CLEVELAND, OHIO.—The City Council contemplates the purchase of cables and accessories, to cost $40,000; ducts, manholes and underground equipment, $15,000, and transformers, poles, wire, etc., $55,000. G. Beckwith, City Hall, is engineer.

MARTIN'S FERRY, OHIO.—Bonds to the amount of $400,000 have been voted for the reconstruction of the municipal electric light plant and waterworks system.

TOLEDO, OHIO.—Plans have been prepared by the Chevrolet Motor Company, General Motors Building, Detroit, for the erection of a transmission manufacturing plant, 91 ft. x 450 ft., one story; heat-treating building, 100 ft. x 120 ft., one-story, and a power house, 60 ft. x 90 ft. A. Kahn, Marquette Building, Detroit, is architect.

INDIANAPOLIS, IND.—Electric power equipment, ice and refrigerating machinery will be installed in the proposed municipal market. The cost is estimated at about $1,000,000.

TERRE HAUTE, IND.—The Central Indiana Power Company has plans under way for the construction of a 10,000-hp. plant on the Wabash River, 12 miles south of Terre Haute. Property, including a coal mine, has been purchased. The cost of the project is estimated at $7,000,000. The company has taken over the systems of the Merchants' Light & Power Company, Indianapolis; the Wabash Valley Electric Company, Clinton, and the Brewer interests.

BLUE ISLAND, ILL.—The Public Service Company of Northern Illinois will erect a transmission line 10 miles from its local power plant to Worth, Chicago Ridge and Palos Park, to supply service in these towns.

CHICAGO, ILL.—The Vassar Swiss Underwear Company, 2545 Diversey Avenue, will install an engine-driven generator set, switchboard, etc., at its power plant. Lockwood, Greene & Company, 38 South Dearborn Street, are engineers.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company has been granted a franchise to extend its electric light and power service in the town of Anson.

FOND DU LAC, WIS.—Plans have been completed by the Gurney Refrigerator Company for a new factory building, 60 ft. x 107 ft., and a power house. Contract for buildings have been awarded, to cost about $50,000.

GREEN BAY, WIS. — Plans are under consideration for the installation of a progressive street-lighting system.

LADYSMITH, WIS.—The Lake Superior District Power Company has opened negotiations with the town officials of Glen Flora, Hawkins, Ingram, Kennan, Catawba and Prentice to furnish electricity for lamps and motors in these towns from its Big Falls hydro-electric plant. If sufficient business is guaranteed, a transmission line will be erected to supply the service.

MARINETTE, WIS.—The Wisconsin Public Utilities Corporation has acquired a site in Marinette on which it will erect a substation which will connect the 33,000-volt transmission line of the Menominee & Marinette Light & Traction Company with the 66,000-volt line now being erected from Pound.

SUPERIOR, WIS.—The Superior Water, Light & Power Company is planning to install a 2,000-kw. motor-generator set. Among the other improvements contemplated is the changing of a primary voltage from 2,300 to 4,000.

NORTHFIELD, MINN.—Plans are being prepared for the construction of a power house at Olaf's College, to cost about $50,000. John D. Small, 127 North Dearborn Street, Chicago, is engineer.

INDEPENDENCE, IOWA.—The Northeastern Iowa Power Company, Clermont, has started work on a new power station in Independence.

KNOXVILLE, IOWA.—Bids will be received by the director of the United States Veterans Bureau, office of the quartermaster-general, 2306 Munitions Building, Washington, D. C., until Dec. 12, for construction of a Neuro-Psychiatric Hospital at Knoxville, for the Veterans Bureau. The work will include the construction of fifteen buildings, complete with water, lighting, heating and sewer systems.

FREDERICKTOWN, MO.—The installation of two oil-burning units to cost about $25,000, in the municipal electric light plant is under consideration.

POPLAR BLUFF, MO.—The Council is considering the installation of a 500-hp. turbo-generator, to cost about $20,000, in the municipal electric light plant.

ST. LOUIS, MO.—The United Railways Company will construct by day labor its proposed power house and substation at Union Avenue and Maple Street, to cost about $75,000.

ST. LOUIS, MO.—The Light & Development Company of St. Louis, Railway Exchange Building, is preparing plans for a 20,000-kw. power plant on the Mississippi River, to cost about $2,000,000.

ST. LOUIS, MO.—Plans are being prepared by the United States Public Service Company, Railway Exchange Building, for extensions of transmission lines 15 miles in southeast Missouri, 40 miles in Texas and several miles near Mitchell, S. D., to cost $125,000; enlarging various power plants, at a cost of about $200,000, and extensions and equipment for same, $200,000. The company is associated with the Light & Development Company of St. Louis.

SEDALIA, MO. — The Sedalia Light & Traction Company is preparing plans for a power plant, to cost about $350,000.

PIERPONT, S. D. — The erection of a high-tension transmission line from Pierpont to Andover is under consideration. The town has contracted with the Aberdeen (S. D.) Light & Power Company to furnish electricity here.

MILFORD, KAN.—Bonds to the amount of $6,500 have been voted for the installation of a new electric light plant.

Southern States

ELIZABETH CITY, N. C.—Bonds to the amount of $550,000 have been voted for the installation of an electric light and power plant and waterworks system.

ATLANTA, GA.—The White Provision Company plans to build a power plant in connection with its new meat-packing plant on the Howell Mill Road, to cost about $350,000. Ice and refrigerating machinery will also be installed.

CHATTANOOGA, TENN.—The Southern Sheet Steel Company, recently organized, will build a power house in connection with its proposed local mills to cost about $1,000,000. W. J. Lynch, vice-president, is in charge.

BROOKHAVEN, MISS. — Bids will be received by the Mayor and Board of Aldermen until Dec. 5 for one 500-kw. steam turbo-generator, one condenser for turbine and switchboard. R. S. Purser is superintendent of the Light and Water Department.

TUNICA, MISS.—Bids will be received by the Board of Supervisors until Dec. 4 for electrical fixtures for the new court house. Frank P. Gates, Clarkesdale, is architect. L. C. Shannon is clerk.

HOUMA, LA.—Bids will be received by the Mayor and Board of Aldermen until Dec. 19 for construction of a waterworks system with mechanical filtration plant and electric power station, including a pumping plant of 1,000,000 gal. daily capacity, consisting of three units, including fire pump, rated at 1,000 gal. per minute, all motor-driven; oil engine-driven generator sets, 10,000,000-gal. earthen storage reservoir, 1-mile transmission line, etc. Massena L. Culley, Jackson, Miss., is designing engineer; T. Baker Smith, Houma, is resident engineer.

ADA, OKLA.—The Oklahoma Portland Cement Company will build a power plant for service at its local cement mill and its branch mill at Lawrence.

HENNESSEY, OKLA. — The Oklahoma Gas & Electric Company will rebuild its transmission line from Enid to Hennessey. Work has been started on a new line to Oilton, Okla.

WETUMKA, OKLA. — Plans are being prepared for extensions to the municipal electric light plant, waterworks and sewerage system, to cost about $150,000. V. V. Long & Company, Colcord Building, Oklahoma City, are consulting engineers.

BUENA VISTA, TEX.—Plans are being prepared for a new power house for the Chickasaw County Agricultural High School to replace the one recently destroyed by fire.

PANHANDLE, TEX. — Electric power equipment will be installed at the municipal waterworks in connection with proposed extensions, to cost about $50,000.

Pacific and Mountain States

MOUNT VERNON, WASH.—A hydro-electric project with an ultimate capacity of 40,000 hp. is being developed by the Delta Electric & Water Company in Skagit County. The first unit, to be located at the outlet of Lake Cavanaugh, will be equipped with a 1,500-kw. generating unit operating under a 105-ft. head. The company will sell energy at wholesale and will also supply service to about 1,000 rural consumers in the Mount Vernon-Skagit River delta district.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, County-City Building, until Dec. 8 for superstructure machinery and electrical equipment of a steel bascule bridge and two side spans over the West Waterway at West Spokane Street. C. B. Bagley is secretary.

CORONADO, CAL.—The San Diego Consolidated Gas & Electric Company will make extensions and improvements to the local street-lighting system, to cost about $15,000.

LOS ANGELES, CAL.—Application has been filed by the city of Los Angeles with the United States Government for permission to build a power house on the aqueduct at Haiwee Narrows, 2 miles below the Haiwee Reservoir. The proposed power station will have a capacity of about 6,400 hp.

SAN DIEGO, CAL.—Bids will soon be called by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for telephone conduit, cables and terminals, for use at the local shipyard. (Specification 4757.)

SAN FRANCISCO, CAL.—Bids will be received by the city and county of San Francisco until Dec. 6 for an electric traveling crane for the Moccasin Creek power plant, contract No. 70, Hetch Hetchy water supply. W. J. Fitzgerald is secretary.

SAN FRANCISCO, CAL. — The Yuba Development Company, Hobart Building, has been granted permission by the State Water Commission to construct a hydro-electric power plant on the North Yuba River, to develop 19,900 hp. at a cost of about $1,500,000.

SESPE, CAL.—The Sespe Light & Power Company has been granted permission to construct a 46,800-hp. hydro-electric plant on Sespe Creek, to cost about $5,000,000.

VENICE, CAL.—The Southern California Edison Company has filed plans for the erection of a substation on Virginia Avenue, to cost about $53,000.

WALLACE, IDAHO.—The Galena Mining Company, operated by the Callahan Zinc-Lead Company, will install electric power equipment in connection with its proposed new mill in the Cœur d'Alene district.

FLORENCE, ARIZ.—At an election held recently the proposal to issue $200,000 electric power district bonds was approved. It is proposed to erect a transmission line from the system of the Salt River Valley Water Users' Association at Sacaton to the State Prison. Other lines will be extended to Casa Grande through the farming district.

RAWLINS, WYO.—The Producers' & Refiners' Corporation, California Building, Denver, will build a power house and electric pumping plants in connection with its proposed new oil refinery at Greensville, near Rawlins, to have an initial capacity of 10,000 barrels per day.

Canada

VANCOUVER, B. C.—The British Columbia Electric Railway Company has entered into a contract with the Britannia Mining & Smelting Company to furnish from 4,500 hp. to 6,000 hp. The power company will erect a 34,000-volt transmission line from North Vancouver to the mine at Britannia, a distance of 30 miles, to cost about $150,000. Energy will be delivered to a substation to be erected by the mining company.

WEST VANCOUVER, B. C.—A bylaw has been passed authorizing a contract for light and power service from the British Columbia Electric Railway Company. A distribution system, to cost about $35,000, will be installed.

BRANDON, MAN.—The Canada Gas & Electric Company contemplates improvements to its plant including the installation of new boilers and machinery.

BRODHAGEN, ONT.—The Council of Logan Township is considering the installation of an electric lighting and power distribution system, to cost about $40,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 31, 1922)

1,433,618. METAL ANODE FOR ELECTRODEPOSITION AND PROCESS OF PRODUCING SAME; G. B. Hogaboom, New Britain, Conn. App. filed Feb. 25, 1921. Nickel anode with low rate of corrosion.

1,433,622. BRAZED ROTOR CONSTRUCTION; C. E. Johnson and N. E. Brown, Los Angeles, Calif. App. filed June 1, 1920. Applied to induction motors having bar-type rotor.

1,433,646. LIQUID RHEOSTAT; D. M. Petty, Bethelhem, Pa. App. filed June 23, 1921. Adapted for regulating large three-phase induction motor of the slip-ring type.

1,433,669. STORAGE BATTERY; M. J. Towns, Tyler, Tex. App. filed April 8, 1921. Separators fastened to bottom of battery extend part way up.

1,433,674. ELECTRICALLY HEATED DRYING ROLL FOR PRINTING PRESSES; M. J. Carl, Cleveland, Ohio. App. filed June 14, 1921. Sheets pass over roll before delivery.

1,433,680. PLATE TERMINAL FOR STORAGE BATTERIES; B. Ford, Philadelphia, Pa. App. filed June 9, 1920.

1,433,681. SECONDARY OR STORAGE BATTERY; B. Ford, Philadelphia, Pa. App. filed March 21, 1922. Pertains to connections for storage-battery parts.

1,433,686. DEVICE FOR ATTACHING CONDUCTORS TO BRUSHES; W. Siebenmorgen, Westfield, N. J. App. filed Nov. 4, 1919. Pigtails on opposite side held by screws.

1,433,687. DEVICE FOR ATTACHING CONDUCTORS TO BRUSHES; W. Siebenmorgen, Westfield, N. J. App. filed April 3, 1922. Plates holding pigtails bolted through brush.

1,433,691. HEAT CARTRIDGE; J. C. Woodson, Mansfield, Ohio. App. filed Nov. 20, 1920. Inclosed heating element of compact form.

1,433,693. FILM CUT-OUT; A. L. Atherton, Edgewood Park, Pa. App. filed Aug. 10, 1918. Film cut-out for series-lighting system.

1,433,697. RESISTOR; A. H. Candee, Pittsburgh, Pa. App. filed Feb. 15, 1919. Arrangement by which the grids may be properly spaced.

1,433,698. ELECTRIC WATER HEATER; C. H. Carlson, Minneapolis, Minn. App. filed Aug. 29, 1921. Heating element placed in supply pipe.

1,433,700. ELECTRIC TOOL-TEMPERING FURNACE; O. A. Colby, Irwin, Pa. App. filed May 4, 1920. Electric resistance type.

1,433,701. TRANSFORMER; G. H. Cole, Wilkinsburg, Pa. App. filed Nov. 20, 1920. Tongue wedge constructed of non-conducting and non-magnetic material.

1,433,711. ELECTRIC AIR HEATER; F. F. Forshee, Flint, Mich. App. filed Dec. 2, 1920. Reflector-type room heater.

1,433,712. CIRCUIT-INTERRUPTING DEVICE; C. LeG. Fortescue, Pittsburgh, Pa. App. filed June 17, 1918. Relay trips circuit when surge comes on line.

1,433,717. ELECTRICAL SYSTEM; A. J. Hall, Wilkinsburg, Pa. App. filed Oct. 30, 1918. Circuit-breaking closed pneumatically and tripped electrically.

1,433,725. CONTROL OF SINGLE-PHASE MOTORS; O. S. Jennings, Wilkinsburg, Pa. App. filed June 13, 1917. Split-phase type operated over wide range of speed.

1,433,726. MOTOR-CONTROL SYSTEM; H. H. Johnston, Edgewood, Pa. App. filed Jan. 14, 1921. Automatic acceleration of industrial locomotive when operator actuates controller too rapidly.

1,433,735. SHERARDIZING FURNACE; A. M. MacFarland, Pittsburgh, Pa. App. filed Aug. 18, 1921. Tiltable double-wall heat-insulating tubular casing.

1,433,736. ELECTROLYTIC APPARATUS; R. D. Mershon, New York, N. Y. App. filed Feb. 27, 1920. Pertains to flow of electrolyte in condensers, rectifiers and lightning arresters.

1,433,739. ELECTRICAL MEASURING INSTRUMENT; W. G. Mylius, Wilkinsburg, Pa. App. filed Oct. 8, 1918. Attachment for integrating watt-hour meter to constitute a maximum-demand meter.

1,433,740. RHEOSTAT; H. C. Nagel, Wilkinsburg, Pa. App. filed Dec. 22, 1919. Pair of resistors side by side and sliding steel ball resting upon both resistors.

1,433,749. CAR-LIGHTING SYSTEM; G. F. Smith, Wilkinsburg, Pa. App. filed Dec. 22, 1919. Supplies constant voltage.

1,433,750. RHEOSTAT; T. Spooner, Pittsburgh, Pa. App. filed Dec. 17, 1919. Slide-wire resistance.

1,433,752. BLOWER FOR DYNAMO-ELECTRIC MACHINES; C. W. Starker, Pittsburgh, Pa. App. filed Feb. 8, 1918. Air-agitating device attachable to rotating member.

1,433,758. ELECTRIC CAR-HEATING SYSTEM; F. Thornton, Jr., Mansfield, Ohio. App. filed May 4, 1920. Car-heating element located in seat pedestal.

1,433,760. ELECTRIC STARTER FOR INTERNAL-COMBUSTION ENGINES; Z. R. della Veneria, Turin, Italy. App. filed March 11, 1921.

1,433,765. SINGLE-PHASE MOTOR; C. A. M. Weber, Edgewood Park, Pa. App. filed June 29, 1918. Split-phase type.

1,433,807. INCANDESCENT LAMP; F. A. Feldkamp, Newark, N. J. App. filed Sept. 26, 1919. Double filament with automatic means to connect one when other is burned out.

1,433,827. ELECTRODEPOSIT WINDING; A. Kimble, Wausau, Wis. App. filed May 12, 1919. Galvanizing rotor core and applying electrodeposit of copper thereto.

1,433,852. ELECTRICAL COLLECTING BRUSH STRUCTURE; F. L. Sessions, Lakewood, Ohio. App. filed Jan. 3, 1921. Current collector for welding machine.

1,433,853. METHOD OF ELECTRIC WELDING; G. H. Sethman, Denver, Col. App. filed April 13, 1922. Potential wave form is such that its front face is sinusoidal, top is flat and rear face is logarithmic curve.

1,433,883. ELECTRIC FURNACE; K. Friderich, Paris, France. App. filed May 14, 1920. For fixation of atmospheric nitrogen.

1,433,915. RADIATOR AND ELECTRIC HEATING FIREPLACE; L. M. Specht, Chicago, Ill. App. filed April 18, 1919.

1,433,932. ELECTRIC RESISTANCE ELEMENT; W. P. Bovard, Mansfield, Ohio. App. filed Dec. 20, 1921. Unit type for controlling circuits.

1,433,948. RHEOSTAT; J. Granz, Duluth, Minn. App. filed April 11, 1921. Slide-wire resistor wound on circular core.

1,433,951. THREE-POSITION TRACTIVE RELAY; A. B. Kendall, Maywood, Ill. App. filed Oct. 28, 1920.

1,433,952. LOCKING DEVICE FOR RELAY ARMATURES; A. B. Kendall, Maywood, Ill. App. filed Oct. 28, 1920.

1,433,960. RESISTANCE; N. D. Levin, Columbus, Ohio. App. filed March 31, 1921. For controlling traction motors.

1,433,962. CONTROL MEANS FOR ELECTROMAGNETIC HAMMERS AND THE LIKE; F. W. Meyer, Milwaukee, Wis. App. filed March 18, 1918. For either alternating or direct current.

1,433,973. RAMP RAIL; A. G. Shaver, Chicago, Ill. App. filed May 12, 1919. Third-rail made up of two metals bolted together.

1,433,989. AUTOMATIC SPEED SIGNAL DEVICE; A. M. Echternach, Seattle, Wash. App. filed Jan. 11, 1921. For automobiles.

1,434,010. ELECTRIC FIXTURES; W. A. Harvey, Scranton, Pa. App. filed Aug. 13, 1919. Plug attachment for permanent electric wall and ceiling fixtures.

1,434,041. ELECTRIC LIGHT; C. H. Burton, Washington, D. C. App. filed April 2, 1920. Light attachment for battery cells.

1,434,053. ELECTRIC FURNACE; F. A. J. FitzGerald, Niagara Falls, N. Y. App. filed Dec. 9, 1920. Furnace for calcining carbonaceous material.

1,434,055. MOTOR-CONTROL SYSTEM; C. T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1908. Control of compound motor.

1,434,064. METHOD OF AND APPARATUS FOR FAC-SIMILE TELEGRAPHY; A. Monteilhet, Paris, France. App. filed Sept. 15, 1913.

1,434,072. ALARM SIGNAL SYSTEM FOR AUTOMATIC WATER-GAS-SET CONTROLS; J. H. Taussig, Philadelphia, Pa. App. filed Dec. 20, 1919.

1,434,136. ELECTROMAGNETIC COUPLING; K. Meller, Siemensstadt, near Berlin, Germany. App. filed June 21, 1921. Series regulating resistances for adjustment.

1,434,142. SIGNAL FOR AUTOS AND OTHER VEHICLES; J. O'Donnell, Jr., Philadelphia, Pa. App. filed Sept. 11, 1920. Rear signal indicating right and left turn, stop and back.

1,434,158. MOTOR-CONTROL SYSTEM; W. H. Scott, Norwich, England. App. filed Jan. 30, 1920. Electric telemotor for reproducing movements at a distance.

1,434,172. RHEOSTAT FOR ELECTRIC LAMPS; J. H. Wagenhorst, Jackson, Mich. App. filed Feb. 23, 1922. Control of arc lamp used for blueprinting.

1,434,214. RAIL BOND; J. G. Kjellgren, Cleveland, Ohio. App. filed Nov. 22, 1916. Pencil-weld method.

1,434,225. RESISTANCE UNIT; G. A. Rice, Cambridge, Mass. App. filed April 18, 1922. Self-contained unit for use alone or in series with similar units.

1,434,283. TELEGRAPH; A. Cunningham, Brooklyn, N. Y. App. filed Dec. 14, 1917. Selenium cell used for amplifying signals on long submarine cables.

1,434,285. ELECTRIC WELDING MACHINE; F. G. Gale, Waterville, Quebec, Can. App. filed Oct. 21, 1921. Welds the ends of a plurality of tubes or bars simultaneously to side of another tube or bar.

1,434,293. TROLLEY WHEEL AND FROG; J. Kushnier, Avella, Pa. App. filed May 27, 1922. Frog constructed to prevent wheel jumping from wire at turns and crossings.

1,434,303. ELECTRIC BATTERY; E. L. Marshall, Fremont, Ohio. App. filed Feb. 18, 1915. Uncooked flour between the container and lining.

1,434,307. STORAGE-BATTERY POST; E. A. Miller, Youngstown, Ohio. App. filed Oct. 28, 1920.

1,434,309. STARTER FOR INTERNAL-COMBUSTION ENGINES; T. E. Nelson, Minneapolis, Minn. App. filed May 13, 1920.

1,434,310. VACUUM RECTIFIER; J. Nienhold, Berlin, Germany. App. filed Feb. 21, 1921. Mercury-vapor rectifier filled with rare gas.

1,434,316. BEARING END PLATE FOR THE IGNITION APPARATUS OF INTERNAL-COMBUSTION ENGINES; J. Schneider, F. Billon, Solothurn, and E. Hurlimann, Zuchwil, Switzerland. App. filed Aug. 22, 1919.

1,434,321. BATTERY BOX; A. P. Taber, Red Wing, Minn. App. filed June 6, 1922. for holding "B" batteries.

1,434,346. APPARATUS FOR REGULATING THE VOLTAGE OF METAL VAPOR RECTIFIER INSTALLATIONS; J. Jonas, Baden, Switzerland. App. filed Oct. 4, 1920. Regulated by direct-current source.

(Issued Nov. 7, 1922)

1,434,362. SYSTEM OF ELECTRICAL DISTRIBUTION; W. L. Bliss, Niagara Falls, N. Y. App. filed Feb. 26, 1917. Voltage regulation on variable-speed generator.